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Aircraft Certification
Regulatory Program

PROJECT SMART VOLUME II ACO CERTIFICATION ENGINEERS: Mechanical-Environmental Systems

*Task & KSA Information
Designing a Competency-Based Model
For Effective Job Performance*



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At a glance . . .

The information presented here has been developed and compiled from various sources--the Job Task Analysis Descriptive Work Procedures, a survey of all ACRP specialists, task and KSA panels. This book may be thought of as a working "data base" that identifies the important tasks performed by specialists; describes in detail the essential knowledges, skills, and abilities (KSA's) required to accomplish the tasks; establishes a preliminary linkage between tasks and KSA's; defines levels of proficiency in demonstrating KSA's and training needed to attain each level; and finally, proposes two applications of the data base that are training-related. The data are organized to meet the needs of all specialists within the ACRP: engineers, inspectors, flight test pilots, supervisors, training coordinators, personnel administrators, and managers at every level. Together the Descriptive Work Procedures and Task and KSA books directly support the ACRP in accomplishing its strategic planning objectives and enhancing its effectiveness in promoting aviation safety.

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SECTION 1 - INTRODUCTION

FAA Aircraft Certification Service As derived from the Federal Aviation Act of 1958, the mission of the Aircraft Certification Service* is to

"promote safety of flight of civil aircraft within the United States and abroad by prescribing standards governing the design, production quality assurance, and airworthiness certification (or approval) of aeronautical products; by administering a certification program to find compliance with the prescribed standards; and, by taking enforcement or regulatory action to assure compliance and to require correction of unsafe conditions found to exist."

This charter incorporates the major activities of certification (design type certification, production certification, airworthiness certification), continued airworthiness programs (including enforcement), and regulatory and policy development.

Directorate System

FAA Order 8000.51, "Aircraft Certification Directorates" (February 1, 1982) established four aircraft certification directorates to obtain a greater level of certification effectiveness, national standardization, and accountability in the application of airworthiness standards. Each directorate would have specific responsibility for carrying out certification, continued airworthiness, and regulatory functions. The concept of an "accountable directorate" became a reality -- a single directorate would have the "authority, accountability, and responsibility" for managing certification programs and standardizing policy for an assigned part of the Federal Aviation Regulations:

- o Small Airplane Directorate, Aircraft Certification Service (Central Region) FAR Part 23
- o Transport Airplane Directorate, Aircraft Certification Service (Northwest-Mountain Region) FAR Part 25

Continued . . .

* Formerly the Office of Airworthiness.

SECTION 1 - INTRODUCTION

- | | |
|---|---|
| Directorate System
(Continued) | <ul style="list-style-type: none">o Rotorcraft Directorate, Aircraft Certification Service (Southwest Region) FAR Parts 27 and 29o Engine and Propeller Directorate, Aircraft Certification Service (New England Region) FAR Parts 33 and 35 |
|---|---|

Staff offices were established within each directorate to develop new regulations and amend existing regulations as needed. They also develop regulatory guidance to supplement regulations.

Aircraft Certification Offices (ACO's) are empowered to administer and verify compliance with FAA regulations and procedures for approving type design, and maintaining certificate integrity (continued airworthiness). Manufacturing Inspection District Offices (MIDO's) verify a manufacturer's quality control systems, certify the airworthiness of aircraft and aircraft products, and provide on-going surveillance of the aviation industry.

The ACRP

The overall work of the Aircraft Certification Service is embodied in the Aircraft Certification Regulatory Program (ACRP). The goal of this program is to promote aviation safety by establishing regulatory standards for the design, production, and airworthiness of aeronautical products and for the assurance of continued safety through surveillance and enforcement programs.

There are three major functions of the ACRP in order of priority: certificate integrity, regulatory and policy development, certification.

- o Certificate integrity includes monitoring and supervising designees and designated facilities, surveilling production approvals, monitoring aviation safety through the service difficulty program and correcting unsafe conditions found to exist, investigating aircraft accidents, responding to National Transportation Safety Board recommendations and safety inquiries, interacting with foreign airworthiness authorities, and issuing airworthiness directives.

Continued . . .

SECTION 1 - INTRODUCTION

The ACRP (Continued)

- o Regulatory and policy development deals with issuing or revising FAR, advisory circulars, orders, action notices, and procedural/policy guidance letters.
- o Certification generally covers design approval of aircraft, aircraft parts, engines and propellers; various production and quality control approvals; airworthiness certification of products; and approval of individual designees and designated facilities.

Each of these major functions was examined in considerable detail in a job task analysis completed under Project SMART.

Project SMART Job Task Analysis

Initiated by the Aircraft Certification Service, Project SMART's fundamental goal is to enhance the effectiveness of the ACRP in promoting aircraft safety. Project SMART has a variety of major initiatives, one of which is a job task analysis (JTA). The JTA is expected to provide the ACRP with a comprehensive data base of the tasks performed by ACRP specialists to accomplish their functions and of the knowledges, skills, and abilities (KSA's) needed to perform those tasks. Data collected through the JTA support the ACRP in its human resource management activities--managing the recruitment, selection, development, training, retention, and utilization of people to enhance organizational effectiveness. Specialists who participated in the JTA included ACO certification engineers, flight test pilots, manufacturing inspectors, project managers, project officers, and regulations and guidance professionals. Supervisors and managers were also active participants.

SECTION 1 - INTRODUCTION

Descriptive Work Procedures Books The JTA has yielded two major products. The first of these, a set of Descriptive Work Procedures (August 1988), covered the work of specialists in all of the products provided by the ACRP. The information is organized in ten volumes as shown here:

- I Design Approval-ACO Certification Engineers
- II Design Approval-Flight Test
- III Design Approval-Aviation Safety Inspectors (Manufacturing)
- IV Design Approval-Project Officers
- V Production Approval and Surveillance
- VI Airworthiness Approval
- VII Appointment and Surveillance of Designees and Designated Facilities
- VIII Service Difficulty Program and Other Certificate Integrity Services
- IX Regulatory Development
- X Policy Development and Support Activities

Each volume thoroughly documents the work of ACRP specialists highlighting both major areas of responsibility and the processes for accomplishing work in these areas.

Task and KSA Books

You're holding one of thirteen volumes of the second major JTA product, the Task and KSA books. The Task and KSA books summarize the relationship between relevant task and KSA information about each ACRP specialty group and complement the Descriptive Work Procedures volumes. While the Descriptive Work Procedures focus on job requirements by describing detailed steps and procedures for each task, the Task and KSA books emphasize personal requirements by describing the KSA's needed by specialists to perform their tasks.

Continued . . .

SECTION 1 - INTRODUCTION

**Task and KSA Books
(Continued)** The Task and KSA books are organized by individual specialty:

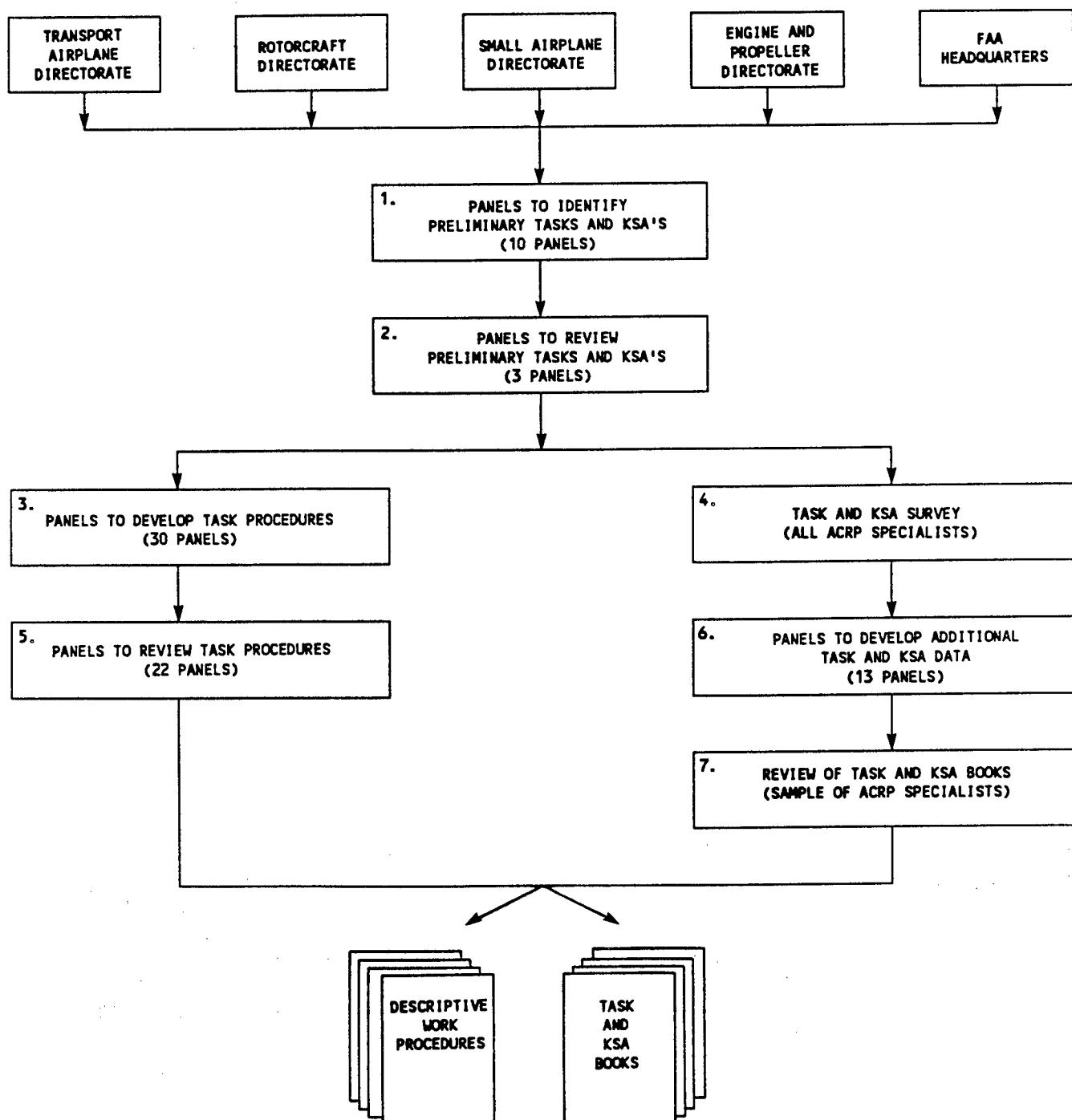
- I ACO Certification Engineers: Structures
 - II ACO Certification Engineers: Mechanical-Environmental Systems
 - III ACO Certification Engineers: Avionics-Electrical Systems
 - IV ACO Certification Engineers: Propulsion Installation
 - V ACO Certification Engineers: Engine Certification
 - VI ACO Certification Engineers: Flight Test
 - VII ACO Flight Test Pilots
 - VIII Aviation Safety Inspectors (Manufacturing)
 - IX Regulations and Guidance Professionals: Engineers
 - X Regulations and Guidance Professionals: Flight Test Pilots
 - XI Regulations and Guidance Professionals: Manufacturing Inspectors
 - XII Supervisors and Managers
 - XIII Project Managers
-

Data Collection Methodology

The data collection process for the JTA involved two methods: representative panels of specialists serving as subject matter experts and a national survey of all ACRP specialists. Figure 1-1 describes the ACRP organizations from which participants were drawn for each major data collection activity, the seven major data collection activities in the process, and the JTA products developed as a result of the analysis.

SECTION 1 - INTRODUCTION

FIGURE 1-1
JOB TASK ANALYSIS PROCESS AND RESULTS



SECTION 1 - INTRODUCTION

Panel Process The process used to develop the job task analysis data relied on panels of specialists from the four directorates including field personnel and FAA Headquarters representatives. In all, 78 panels were conducted involving over 300 participants. A building-block approach was used to develop the information. First, panels were convened to develop preliminary information (e.g., a list of all tasks performed). Then subsequent panels reviewed and refined preliminary information before developing any new data. Supervisors always participated in review panels as did a specialist from the panel that developed the information. This "rolling panelist" approach ensured continuity throughout the overall data collection and validation process.

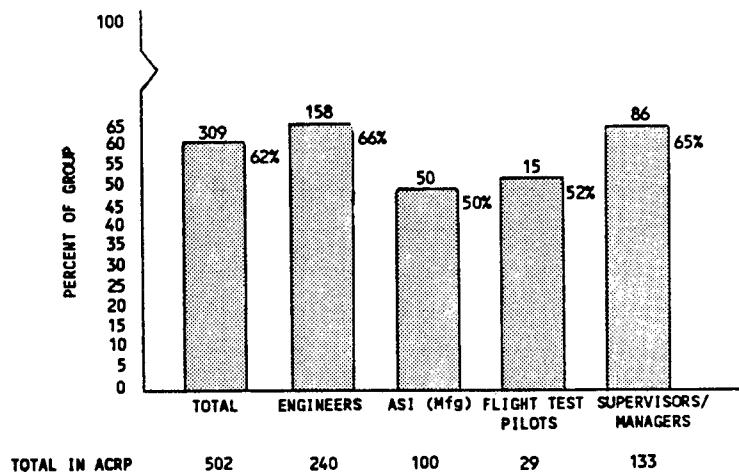
Panelists were challenged not only to record the tasks they do and how they do them, but, where differences existed, to achieve consensus on how best to perform the work. The resulting information then is both descriptive of actual work and prescriptive for suggested ways of accomplishing the work. As panelists recorded their tasks for each product, they discussed and analyzed their responsibilities and eventually reached a consensus within the panel on just what their work was. This "consensus building" theme was also used to develop the KSA information. Consensus is important since it encourages the widest range of viewpoints and enhances the acceptability and use of the information.

SECTION 1 - INTRODUCTION

Panel Participation Rate

Approximately 62% of all ACRP specialists participated in at least one panel, and nearly one-quarter of them participated in more than one panel. The broad based participation of ACRP personnel in the "rolling panel" process is depicted in Figure 1-2.

FIGURE 1-2
LEVEL OF STAFF PARTICIPATION IN JTA PANELS



ACRP Task Questionnaire

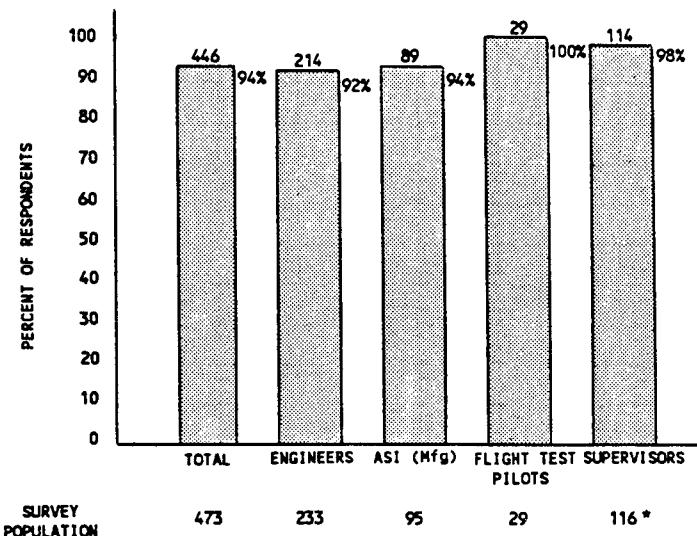
A survey of all ACRP specialists identified task and KSA importance, task difficulty and frequency, and the respondents' perceptions of their need for training in the task. Prior to distribution, a sample questionnaire was presented to a representative group of specialists and later modified based on their feedback. To expedite the survey process, Project SMART coordinators from each directorate participated in a conference to plan the distribution and collection of questionnaires. Task questionnaires were tailored to each group of specialists, listing all tasks and KSA's identified for each group. Both job incumbents and supervisors received a questionnaire. Supervisors were asked to rate the importance of tasks and KSA's as well as their staffs' need for training on each task. The resulting data permitted a comparison of employee and supervisory perspectives.

SECTION 1 - INTRODUCTION

Survey Response Rate

As Figure 1-3 indicates, the overall response rate to the survey was an extremely high 94%.

FIGURE 1-3
SURVEY RESPONSE RATE



* Number of surveys sent and returned, not individuals. Some supervisors received more than one survey.

Comprehensive Data Base

Together, the two JTA products provide a job-based, comprehensive, up-to-date, uniform, and integrated description of the work of ACRP specialists and the KSA's required to successfully accomplish that work.

- o **Job-based.** The scope of documentation includes all products internal or external to the ACRP that involve its specialists.

Continued . . .

SECTION 1 - INTRODUCTION

- Comprehensive Data Base (Continued)**
- o **Comprehensive and complete.** The documentation presents the tasks performed by all ACRP specialists for each ACRP product and the KSA's required by the specialists to perform those tasks.
 - o **Up-to-date.** The JTA products reflect current task and KSA requirements.
 - o **Uniform.** The format and presentation of information for the two major JTA products is standardized.
 - o **Integrated but modular.** Task and KSA information can be viewed horizontally and vertically. The horizontal picture takes a single product and shows the work of all specialists who have any involvement in the product. Vertically, the JTA identifies all products for an individual specialty.
 - o **Immediate relevancy.** The information supports and has immediate application for most of the organization's strategic goals that require this data base (see Project SMART, A Plan for Performance, FY 89).

In short, the JTA information provides a basis for establishing a competency-based model that describes effective job performance for all ACRP specialists.

Competency-Based Model

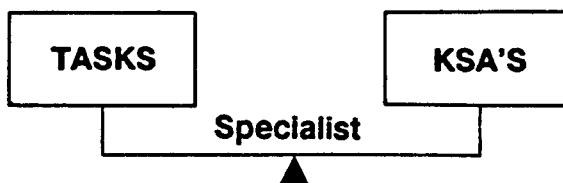
A primary purpose of the JTA is to provide a data base that would support the development of a "model" of effective performance for all ACRP specialists. To be successful in accomplishing the work required for a particular product (e.g., type certificate, production approval, airworthiness approval), the specialist must know what tasks are to be done and possess the KSA's to do them correctly. For a model to be "competency-based," it must not only define the tasks that, when completed, result in a product, but also describe the knowledges and skills needed for successful task performance. Both elements -- required tasks and essential knowledge -- are closely related and interact within a "framework of products" that ACRP specialists are responsible for.

Continued . . .

SECTION 1 - INTRODUCTION

Competency-Based Model (Continued)

The interaction of tasks and KSA's is much like a scale that constantly seeks balance.



As new or more complex tasks are added to the work of the specialist because of increased complexity of products, the need for new/additional KSA's rises. As that knowledge is attained, balance is restored. And as a specialist acquires new knowledge, he or she may now be ready to take on additional tasks. The important point is that the interaction of tasks and KSA's is on-going and mutually reinforcing.

Ultimately the products for which the ACRP is responsible will determine the essentiality of knowledges and importance of tasks for its people. The current technological environment of the aviation industry certainly influences and drives the work of ACRP specialists. This environment is dynamic--incorporating new technologies, developing new products, exploring new applications. Evolution and change in the aviation industry directly affect the ACRP mission, and specialists must constantly expand their technical understanding and expertise to analyze, inspect, and regulate numerous products. For them the one constant is change.

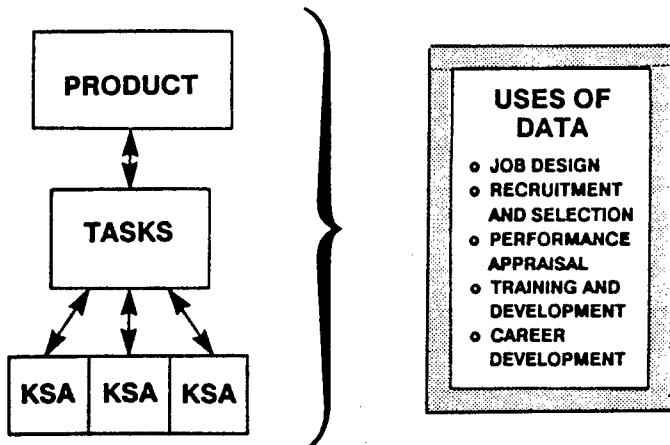
A competency-based model of effective job performance, in turn, supports the ACRP in managing the selection, development, and utilization of its most valuable asset--human resources. The model is competency-based because it describes the KSA's required to successfully perform job tasks that, when completed, result in a product. Figure 1-4 shows the interrelationship of tasks and KSA's within the context of product applications and identifies some potential uses of this information.

Continued . . .

SECTION 1 - INTRODUCTION

Competency-Based Model (Continued)

FIGURE 1-4
**INTEGRATIVE FRAMEWORK FOR DEVELOPING A
COMPETENCY-BASED MODEL FOR ACRP SPECIALISTS**



Organization of this Volume

Each of the elements of the competency-based model will be discussed in the subsequent sections of this book:

Section 2 describes the survey respondents, and contains a summary of the survey results regarding task characteristics: importance, difficulty, frequency, need for training, and an overall job criticality rating for tasks performed by over 25% of the respondents. Appendix A contains these characteristics for tasks performed by 25% or fewer survey respondents.

Section 3 discusses the KSA's needed for successful performance of the tasks. The KSA importance ratings from the survey and KSA proficiency and training requirements information (detailed definitions of each KSA, illustrations of proficiency for different levels of application, and training) are presented. Information establishing the linkage of the KSA's to the highest rated critical tasks is provided in Appendix B.

Continued . . .

SECTION 1 - INTRODUCTION

**Organization
of this
Volume
(Continued)**

Section 4 underscores the interrelationship of task and KSA information by providing two examples of how the information may be applied. One example shows how the information can be used to develop a National Training Program for the ACRP; the other shows how it can be used for individual development planning.

SECTION 2 - SUMMARY OF TASK INFORMATION

Introduction This section presents the task component of the competency-based model by describing the task information collected through a survey of all ACO mechanical-environmental systems engineers. The task information answers several questions:

1. What tasks are performed?
 2. How critical are the tasks relative to one another, to the overall job?
 3. What is the relative importance, difficulty, and frequency of the tasks?
 4. What is the need for training on the tasks?
-

ACRP Task Questionnaire A set of tasks was identified, developed, and verified through the rolling panel process for all ACO engineers. To collect additional information about the tasks from the perspective of each engineering specialty, a task questionnaire was designed and sent to all mechanical-environmental systems engineers ($n = 19$). Their supervisors ($n = 9$) also received questionnaires to give their perspective on the tasks as well. Ninety-five percent of the engineers responded and 88% of the supervisors responded. Tables 2-1 through 2-3 describe additional information about the representativeness of the sample of survey respondents--response rate by directorate, grade level and time in grade, and experience working on the major FAR parts.

Continued . . .

SECTION 2 - SUMMARY OF TASK INFORMATION

Table 2-1

**Response Rate by Directorate:
ACO Mechanical-Environmental Systems Engineers and Supervisors**

<u>Directorate</u>	<u>Engineers</u>		<u>Supervisors</u>	
	<u># of Respondents</u>	<u>% of Engineers</u>	<u># of Respondents</u>	<u>% of Supervisors</u>
Engine and Propeller	2	100%	1	100%
Small Airplane	4	100%	3	100%
Transport Airplane	8	89%	3	75%
Rotorcraft	4	100%	1	100%
TOTAL	18	95%	8	88%

Table 2-2

**Response Rate by Grade and
Number of Years in Current Grade**

<u>Grade</u>	<u># of Respondents</u>	<u>% of Engineers</u>	<u># of Years in Current Grade</u>	<u>Average</u>	<u>Range</u>
GS-7	1	100%	1.0	-	
GS-11/12	2	100%	0.5	-	
GS-13	14	93%	8.4	1-25	
GS-14	1	100%	1.0	-	

Continued . . .

SECTION 2 - SUMMARY OF TASK INFORMATION

Table 2-3

Percent of Respondents Who Have Worked On Major FAR Parts in Their Current Job

<u>FAR Part</u>	<u># of Respondents</u>	<u>% of Respondents</u>
FAR 23 - Small Aircraft	12	67%
FAR 25 - Large Aircraft	17	94%
FAR 27 or 29 - Rotorcraft	7	39%
FAR 33 or 35 - Engines or Propellers	1	6%
FAR 31 - Balloons	3	17%
FAR 21 - Special Class	7	39%

ACRP Task
Questionnaire
(Continued)

For each task in the questionnaire, engineers answered the following questions:

TASK CHARACTERISTIC	QUESTION FOR ENGINEERS
PERFORM	Do you perform this task?
IMPORTANCE	How important is this task relative to the other tasks you do on your job?
DIFFICULTY	At this point in time, how difficult is it for you to perform this task, relative to the other tasks you do on your job?
FREQUENCY	How frequently do you perform this task?
TRAINING NEED	In order to accomplish this task, what is your present need for training, either to improve your performance or stay technically up-to-date (i.e., currency, state-of-the-art)? Training includes classroom instruction, on-the-job training, self-instruction, etc.

Continued . . .

SECTION 2 - SUMMARY OF TASK INFORMATION

ACRP Task Questionnaire (Continued)

Supervisors answered similar questions for each task:

TASK CHARACTERISTIC	QUESTION FOR SUPERVISORS
PERFORM	Does your staff perform this task?
IMPORTANCE	How important is this task relative to the other tasks your staff performs?
TRAINING NEED	In order to accomplish this task, what is your staff's current need for training, either to improve their performance or stay technically up-to-date (i.e., currency, state-of-the-art)? Training includes classroom instruction, on-the-job training, self-instruction, etc.

Task Characteristic Data

A task characteristic by itself or in combination with others yields useful information about individual tasks or groups of tasks.

For example, importance, difficulty, and frequency, taken together, provide a measure of the overall criticality of a task to the job. Tasks that have a relatively higher job criticality--that is, they are relatively more important, more difficult, and occur with greater frequency--are more likely candidates for training and development efforts than tasks with relatively low job criticality.

Another application of the information is in identifying which tasks may have greater immediacy for training. Respondents' reports of their current need for training is an indication of immediacy. For example, tasks which have both high job criticality and high perceived need for training are probably more training critical than tasks with high job criticality but low perceived need for training.

The task characteristics data can also be used to help identify, in a broad way, appropriate training methodologies. For instance, if tasks are relatively high in importance, but low in difficulty and frequency, training might take the form of desk references. On the other hand, if tasks are highly important, difficult, and performed often, training might be best accomplished through on-the-job or formal classroom training programs.

SECTION 2 - SUMMARY OF TASK INFORMATION

Survey Analysis Respondents rated each task characteristic using the numeric scales below.

TASK CHARACTERISTIC	RATING SCALE
PERFORM	1. Yes 2. No
IMPORTANCE	1. Not Very Important 2. Somewhat Important 3. Important 4. Very Important 5. Extremely Important
DIFFICULTY	1. Not At All Difficult 2. Somewhat Difficult 3. Moderately Difficult 4. Very Difficult 5. Extremely Difficult
FREQUENCY	1. Very Rarely (may be once a year) 2. Infrequently (about once every few months) 3. Occasionally (about once a month, but not weekly) 4. Frequently (at least once a week, but not daily) 5. Extremely Frequently (at least once a day)
TRAINING NEED	1. No Need 2. Slight Need 3. Moderate Need 4. Definite Need 5. Extreme Need

For each task that respondents perform, mean (average) scores were calculated. Thus, for engineers, four scores were calculated: Importance, Difficulty, Frequency, and Training Need. For supervisors, two scores were calculated: Importance and Training Need.

To measure each task's criticality to the job, a job criticality score was computed for each engineer's importance, difficulty, and frequency data using the following formula:

$$\text{JOB CRITICALITY} = (\text{IMPORTANCE} \times \text{DIFFICULTY}) + \text{FREQUENCY}$$

Continued . . .

SECTION 2 - SUMMARY OF TASK INFORMATION

Survey Analysis (Continued)

These scores were then averaged to derive the job criticality score for each task. (Manual calculation of this score will differ somewhat from reported results due to averaging and rounding of figures by the statistical program.)

Based on this formula, the highest possible job criticality score is 30, or $(5 \times 5) + 5$ and the lowest is 2, or $(1 \times 1) + 1$. Job criticality scores for mechanical-environmental systems engineers ranged from about 7 to 21; individual scores for each task should be interpreted relative to one another.

Mean scores for task importance, difficulty, frequency, training need, and job criticality are presented in Table 2-4 for those tasks performed by over 25% of the survey respondents. Supervisors' mean ratings are also listed. The full task statements as developed and validated in the panels are included. Appendix A contains mean scores for tasks performed by 25% or fewer of the respondents. This appendix includes tasks that are performed by relatively few, if any, individuals. Table 2-4 together with Appendix A represents the full set of tasks contained in the survey.

Some other features of Table 2-4 and Appendix A:

- o Tasks are listed in rank order (highest to lowest) based on their job criticality score.
 - o Supervisors' ratings of importance and training needed were statistically compared with engineers' ratings to determine whether they differed significantly. Any significant differences between the ratings are noted with an asterisk; generally, there were few significant differences. In some instances, statistical tests could not be computed because of the small number of responses or lack of variance within the scores. These are noted with two asterisks.
 - o In the last column each task is identified by its related product, for example, "Type Certificate: Domestic," "Standard Airworthiness Approval," "Airworthiness Directive," etc. To facilitate cross-referencing to the Descriptive Work Procedures, these products correspond to those in the volumes.
-

SECTION 2 - SUMMARY OF TASK INFORMATION

Special Note As in the Descriptive Work Procedures, the tasks presented in this book reflect the tasks as identified and validated by the JTA panels. Two special notes are in order.

First, the task survey listed all tasks performed by all ACO engineering specialists. While most of the tasks are common to all disciplines, some similar sounding tasks will have slight variations in wording to more accurately reflect the exact work of a specialist (e.g., "Interfaces with AEG during the certification process" vs. "Participates in Flight Standardization Board, as requested").

Secondly, the questionnaire was administered while a small number of task validation panels were still on-going. During the validation panels, participants had an opportunity to make final modifications, additions, or deletions to the tasks. Most of the changes made during these panels were very minor and do not affect the task survey ratings. Task changes that were significant are noted in the lists of ratings.

TABLE 2-4
ACQ MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>		<u>IMPORTANCE ENG SUPVR</u>		<u>TRAINING NEED DIFF FREQ</u>		<u>PRODUCT ENG SUPVR</u>	
		<u>ENG</u>	<u>SUPVR</u>	<u>ENG</u>	<u>SUPVR</u>	<u>FREQ</u>	<u>DIFF</u>	<u>ENG</u>	<u>SUPVR</u>
1.	Drafts and coordinates airworthiness directive, executive summary, and other documents, as applicable.	16.38	4.19	4.50	3.13	2.63	2.12*	3.25	Airworthiness Directive
2.	Reviews and approves safety analyses (e.g., fault/failure analysis, FMEA) with respect to certification criteria.	16.13	3.87	4.25	3.38	2.63	3.00	3.38	Type Certificate: Domestic
3.	Becomes familiar with the applicant's design/product.	15.94	4.28	3.88	2.78	3.89	2.83	2.75	Type Certificate: Domestic
4.	Provides input items to the TIA.	15.47	3.94	4.13	3.06	3.00	2.47	3.25	Type Certificate: Domestic
5.	Reviews and approves drawings and material and process specifications for certification projects and makes findings of compliance. (See note)	15.41	3.94	3.87	2.94	3.65	2.65	2.88	Type Certificate: Domestic
6.	Participates in the establishment of a certification basis.	15.27	3.87	4.14	3.20	2.67	2.60	3.00	Type Certificate: Domestic
7.	Participates in accident and incident investigations.	15.18	3.82	4.00	3.27	1.91	2.82	2.88	Accident/Incident Investigation
8.	Reviews and approves test plans/procedures.	15.17	3.78	4.38	3.06	3.22	2.78*	3.75	Type Certificate: Domestic
9.	Identifies the need for and develops issue papers during the certification program.	15.17	3.67	3.50	3.33	2.00	2.67	2.17	Type Certificate: Foreign
10.	Identifies the need for and develops issue papers during the certification program.	15.07	4.00	3.86	3.33	2.60	2.25	3.00	Type Certificate: Domestic
11.	Writes or assists in writing TIA.	15.00	3.87	3.71	3.07	2.93	2.33	2.71	Type Certificate: Domestic
12.	Facilitates resolution of differences of opinion with project team and with applicant or directorate.	15.00	3.56	3.75	3.33	2.11	2.56	2.88	Type Certificate (Proj Mgt)

Note: Split into two tasks on the recommendation of the task validation panels as follows: "Reviews and approves drawings" and "Reviews and approves material and process specifications."

* Engineers' mean rating significantly different from supervisors' mean rating (based on two-tailed t-test for independent samples with a $p = .05$).

SCALES

JOB CRITICALITY scores may range from a minimum of 2 to a maximum of 30. (Refer to page 2-5 for detailed explanation). IMPORTANCE (IMP), DIFFICULTY (DIFF), FREQUENCY (FREQ), and TRAINING NEED scores may range from a minimum of 1 to a maximum of 5. (Refer to page 2-5 for description of rating scales.)

TABLE 2-4

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (Continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG</u>	<u>IMPORTANCE SUPVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG</u>	<u>TRAINING NEED SUPVR</u>	<u>PRODUCT</u>
13.	Evaluates and makes recommendations on a request for an equivalent level of safety finding.	14.60	3.93	4.00	3.07	2.20	2.53	2.87	Type Certificate: Domestic
14.	Reviews and approves test results.	14.59	3.88	4.38	2.76	3.35	2.41	2.88	Type Certificate: Domestic
15.	Prepares and coordinates TIA.	14.50	3.80	4.00	2.90	3.20	2.10	2.75	Type Certificate (Proj Mgt)
16.	Reviews and approves analyses.	14.40	3.67*	4.38	2.93	3.20	2.27*	3.38	Type Certificate: Domestic
17.	Conducts type board meetings with applicant.	14.29	3.57	4.00	3.14	2.57	2.86	3.20	Type Certificate (Proj Mgt)
18.	Reviews applicant's certification plan for completeness and provides feedback.	14.25	3.94	3.38	2.81	3.06	2.06	2.38	Type Certificate: Domestic
19.	Coordinates the establishment of overall program certification basis including special conditions and exemptions.	14.22	3.78	4.14	3.11	2.56	2.22	3.00	Type Certificate (Proj Mgt)
20.	Oversees administrative activities of DER's (or of personnel at designated facilities).	14.22	3.56	3.43	2.89	3.56	2.33	1.86	Type Certificate (Proj Mgt)
21.	Prepares letter of TSO authorization after appropriate review required by Part 21, Subpart O and the specific TSO.	14.22	3.50	3.50	2.89	3.60	2.60	2.33	TSO Authorization Letter
22.	Prepares or reviews and accepts applicant's compliance checklist.	14.15	3.69	3.87	3.08	2.62	2.46	2.50	Type Certificate: Domestic
23.	Reviews, specifies, and approves limitations for incorporation in the airworthiness Limitations section of the instructions for continued airworthiness.	13.88	3.63	3.67	3.13	2.38	2.50	2.33	Type Certificate: Domestic
24.	Participates in the establishment of the U.S. certification basis.	13.83	3.67	3.60	3.17	2.33	2.50	2.20	Type Certificate: Foreign

* Engineers' mean rating significantly different from supervisors' mean rating (based on two-tailed t-test for independent samples with a $p = .05$).

TABLE 2-4

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (Cont'd)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG</u>	<u>IMPORTANCE SUPVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG</u>	<u>TRAINING NEED SUPVR</u>	<u>PRODUCT</u>
2-10	25. Assists engineering specialties in resolving technical issues.	13.71	3.43	3.40	3.14	2.57	2.71	1.75	Type Certificate: Domestic
	26. Identifies need for and proposes new or revised FAR or policies as a result of specific certification problems.	13.70	3.40	3.83	3.40	1.50	2.40	2.17	Type Certificate: Domestic
	27. Becomes familiar with the applicant's design/product.	13.70	3.50	3.00	3.20	2.10	2.60	1.83	Type Certificate: Foreign
	28. Evaluates and makes recommendations on a request for an equivalent level of safety finding.	13.67	3.50	4.20	3.17	2.17	2.67	2.60	Type Certificate: Foreign
	29. Assesses the qualifications of the staff members who will exercise authority under the delegation as a designated organization (DOA, DAS, or SFAR 36).	13.67	3.58	3.83	3.08	2.33	2.25	2.50	Delegation as DOA/DAS/SFAR 36
	30. Advises potential applicant regarding requirements related to certification program.	13.61	3.89	4.00	2.44	3.67	2.39	3.13	Type Certificate: Domestic
	31. Evaluates request for an alternate means of compliance, change in compliance time, or an equivalent level of safety proposal for an airworthiness directive.	13.57	3.71	4.00	2.93	2.29	1.71	2.13	Airworthiness Directive
	32. Maintains awareness of certification project status.	13.55	3.91	3.25	2.55	3.55	1.91	2.00	Type Certificate (Proj Mgt)
	33. Coordinates activities with project team and applicant.	13.50	3.50	3.88	2.90	3.20	2.30	2.38	Type Certificate (Proj Mgt)
	34. Drafts new or revised TSO, when requested.	13.44	3.67	3.25	2.89	2.00	2.33	2.00	Technical Standard Order
35.	Reviews and approves drawings and material and process specifications and makes findings of compliance. (See note)	13.40	3.40	3.75	2.93	2.87	2.33	2.13	PMA Letter of Approval
	Serves on Special Certification Review (SCR) team to review certification basis/design approval.	13.20	3.60	3.60	3.20	1.40	1.60	2.00	Special Certification Review

Note: Split into two tasks on the recommendation of the task validation panels as follows: "Reviews and approves drawings" and "Reviews and approves material and process specifications."

TABLE 2-4

**AAC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG</u>	<u>IMPORTANCE SUPERVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG</u>	<u>TRAINING NEED SUPERVR</u>	<u>PRODUCT</u>
37.	Conducts compliance inspection during the certification program.	13.18	3.82	3.86	2.73	2.45	2.27	2.57	Type Certificate: Domestic
38.	Reviews applicant's proposed flight test program.	13.18	3.45	3.43	2.91	2.73	2.18	2.43	Type Certificate: Domestic
39.	Reviews proposed changes to procedures manual (handbook) and organization's staff qualifications.	13.14	3.57	3.60	3.00	2.14	2.43	2.40	Survey of DOA/DAS/SFAR 36
40.	Reviews and approves test plans/procedures.	13.13	3.53	3.75	2.87	2.60	2.00	2.00	PMA Letter of Approval
41.	Reviews the technical work and level of activity of the DER for compliance with regulations.	13.13	3.63	4.00	2.75	3.00	2.19	2.50	Surveillance of DER
42.	Reviews and approves test results.	13.07	3.53	3.62	2.87	2.60	2.00	2.25	PMA Letter of Approval
43.	Identifies tasks to be accomplished by the applicant/DER and the FAA in the certification program.	13.06	3.56	3.75	2.69	3.25	2.19	2.13	Type Certificate: Domestic
44.	Schedules and conducts project-specific meetings (specialist meetings) with the applicant.	13.06	3.89	4.13	2.56	3.00	2.44	2.75	Type Certificate: Domestic
45.	Evaluates and approves applicant's flight test plan(s) including instrumentation requirements.	13.00	3.38	3.60	2.87	2.88	3.00	2.60	Type Certificate: Domestic
46.	Evaluates applicant's pre-TIA engineering data/flight test report.	13.00	3.23	3.50	3.08	2.69	2.54	2.17	Type Certificate: Domestic
47.	Identifies the need for and provides policy guidance and assistance to FCAA/applicant.	12.80	3.20	3.60	3.20	2.00	2.00	2.40	Type Certificate: Foreign
48.	Answers questions from affected parties on the airworthiness directive.	12.75	3.69	3.50	2.75	2.19	1.81	1.88	Airworthiness Directive
49.	Analyzes and disposes of comments on NPMR.	12.75	3.58	3.75	2.75	2.58	1.83	2.25	Airworthiness Directive
50.	Evaluates and responds to Flight Standards accident/incident prevention recommendation.	12.71	3.43	3.25	3.00	2.00	2.29	2.00	Support to Flight Standards

TABLE 2-4

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (Continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>			<u>IMPORTANCE ENG SUPVR</u>			<u>TRAINING NEED ENG FREQ</u>			<u>PRODUCT</u>
		<u>ENG</u>	<u>SUPVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>ENG</u>	<u>SUPVR</u>	<u>DIFF</u>	<u>FREQ</u>		
51.	Provides information/assistance to DER on current policy and utilizes DER expertise on technical issues and in support of policy development.	12.67	3.47	3.63	2.80	2.73	2.40	2.13			Surveillance of DER
52.	Participates in making compliance determination.	12.63	3.38	3.00	3.13	1.87	1.88	2.00			Type Certificate: Foreign
53.	Reviews aircraft flight manual during the certification process (for engineering specialty).	12.57	3.50	3.57	2.64	2.93	2.14	2.71			Type Certificate: Domestic
54.	Reviews certification project correspondence.	12.55	3.45	3.25	2.64	3.45	2.18	2.13			Type Certificate (Proj Mgt)
55.	Provides counseling to DER when necessary.	12.53	3.53	3.75	2.80	2.47	2.14	2.13			Surveillance of DER
56.	Coordinates the development of issue papers and assembles issue book.	12.50	3.25	3.50	2.88	2.25	2.50	2.17			Type Certificate (Proj Mgt)
57.	Schedules and conducts project specific meetings with applicant to coordinate the overall certification program.	12.50	3.20	3.50	3.00	3.00	2.30	2.75			Type Certificate (Proj Mgt)
58.	Reviews procedure manual (handbook) to determine that it complies with the FAR requirements, policy, and procedures for the authorized delegation as a designated organization (e.g., DOA, DAS, or SFAR 36) and makes any applicable suggestions.	12.42	3.50	3.83	2.92	2.08	2.08	2.50			Delegation as DOA/DAS/SFAR 36
59.	Reviews and approves analyses.	12.40	3.30	4.00	3.00	2.00	2.40	2.75			PMA Letter of Approval
60.	Witnesses certification tests (ground).	12.35	3.71	3.75	2.41	2.82	2.35	2.38			Type Certificate: Domestic
61.	Reviews and accepts instructions for continued airworthiness during the certification program.	12.33	3.33	3.17	2.89	2.22	2.67	2.33			Type Certificate: Domestic
62.	Reviews and comments on proposed Federal Aviation Regulations.	12.33	3.20	3.50	2.93	1.87	2.07	2.13			Federal Aviation Regulation
63.	Reviews and evaluates information obtained from various sources and initiates corrective action.	12.31	3.69	4.00	2.31	3.50	1.87	2.25			Prod In-Svc Difficulty Eval

TABLE 2-4
AAC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (Continued)

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG SLVSR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG</u>	<u>TRAINING NEED SVCSR</u>	<u>PRODUCT</u>
64.	Monitors and reviews preparation and completion of compliance checklist.	12.30	3.40 3.88	2.70	2.60	2.10	2.88	Type Certificate (Proj Mgt)
65.	Prepares and coordinates certification program plan (if "significant").	12.22	3.44 3.13	2.78	2.56	2.22	2.25	Type Certificate (Proj Mgt)
66.	Evaluates and responds to National Transportation Safety Board (NTSB) recommendation(s).	12.20	3.10* 4.17	3.20	2.00	2.00	2.17	Response to NTSB Recommendation
67.	Reviews and comments on proposed agency order/action notice.	12.17	3.50 3.33	2.83	1.83	1.67	2.17	Agency Order/Action Notice
68.	Writes or reviews and coordinates TIR.	12.00	3.00 3.00	2.88	2.88	2.75	1.50	Type Certificate: Domestic
69.	Reviews the special purpose and verifies eligibility requirements for certification.	12.00	3.20 3.60	3.00	2.20	2.20	2.60	Type Certificate: Restrict Cat (Modified Military Aircraft)
70.	Evaluates prospective DER, recommends appointment, and provides indoctrination.	11.93	3.47 4.00	2.67	2.47	2.20	2.25	Appointment of DER
71.	Witnesses compliance tests.	11.92	3.25 3.29	2.75	2.42	2.08	2.00	PMA Letter of Approval
72.	Reports, reviews, and analyzes flight test data.	11.75	3.38** 4.00	2.63	2.63	2.50	3.00	Type Certificate: Domestic
73.	Participates in directorate Airworthiness Directive Review Board.	11.75	3.46 4.00	2.62	2.31	1.46	1.60	Airworthiness Directive
74.	Issues letter of design approval for PMA based on compliance to applicable airworthiness requirements.	11.67	3.33 3.25	2.67	2.53	2.13	1.75	PMA Letter of Approval
75.	Determines the airworthiness requirements on the part to be approved for PMA.	11.64	3.21 3.50	2.57	2.79	1.93	2.13	PMA Letter of Approval

* Engineers' mean rating significantly different from supervisors' mean rating (based on two-tailed t-test for independent samples with a p = .05).
 ** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

TABLE 2-4

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (Cont'd)

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE</u>			<u>FREQ</u>	<u>TRAINING NEED</u>	<u>PRODUCT</u>
			<u>ENG</u>	<u>SUPERVR</u>	<u>DIFF</u>			
76.	Participates in certification flight tests.	11.63	3.38	3.17	2.75	2.13	2.63	2.17
77.	Provides expert technical assistance and advice concerning field approvals, if requested.	11.46	3.38	3.63	2.62	2.15	2.08	2.38
78.	Participates in audit of designated organization (DOA, DAS, SFAR 36), as required.	11.45	3.36	4.00	2.73	1.91	2.27	2.40
79.	Prepares agenda items for and participates in type board meetings.	11.42	3.33** 4.00	2.67	2.33	2.17	2.29	Type Certificate: Domestic
80.	Evaluates or proposes specific data reduction and expansion procedures.	11.40	3.20** 4.00	2.80	2.00	2.50**	2.00	Type Certificate: Domestic
81.	Reviews design data for field approval, when requested, to make findings of compliance with appropriate airworthiness requirements.	11.38	3.38	3.88	2.62	2.08	2.15	2.50
82.	Evaluates the modification relative to the special purpose operation.	11.33	3.00	3.80	3.00	2.17	2.00	2.60
83.	Reviews proposed TSO, when requested.	11.25	3.25	3.25	2.50	2.00	1.92	1.88
84.	Participates as a team member in an audit of repair station data approval, when requested, to evaluate engineering data, perform over engineering functions, and report findings.	11.14	3.14	3.14	2.71	1.71	2.86	2.14
85.	Evaluates petitions for exemption to airworthiness directive.	11.00	3.50	4.00	2.50	1.67	1.92	1.60
86.	Seeks policy/guidance from accountable directorate to clarify questions or concerns related to type design or standardization.	10.94	3.50	4.00	2.31	2.56	1.88	2.75

** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

TABLE 2-4

**AAC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (Continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG</u>	<u>IMPORTANCE SUPERVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG</u>	<u>TRAINING NEED SUPERVR</u>	<u>PRODUCT</u>
87.	Provides policy guidance and interpretation of FAR's to the designated facility necessary for compliance with certification/airworthiness requirements.	10.92	3.33	3.67	2.58	1.92	2.00	2.17	Surveillance of DOA/DAS/SFAR 36
88.	Witnesses tear-down inspections during an engine or propeller certification program.	10.80	2.80	4.00	2.80	2.00	2.00	2.50	Type Certificate: Domestic
89.	Provides assistance to aviation safety inspectors (manufacturing) in support of special airworthiness approvals (e.g., experimental, special flight permits, restricted, etc.).	10.70	3.10	3.00	2.70	2.00	2.50	2.33	Special Airworthiness Cert
90.	Conducts reappointment evaluation of DER.	10.60	3.40	3.63	2.33	2.40	1.87	2.00	Surveillance of DER
91.	Reviews applicant's proposed aircraft flight manual/supplement, airworthiness limitations, and instructions for continued airworthiness.	10.57	3.14	3.17	2.57	2.14	2.00	2.00	Type Certificate: Restrict Cat (Modified Military Aircraft)
92.	Reviews and comments on proposed procedural guidance.	10.50	3.00	3.13	2.75	1.92	1.92	1.88	Procedural Guidance Letter
93.	Processes congressional or public inquiries.	10.38	3.00	2.88	3.00	1.50	1.25	1.63	Response to Safety Inquiries
94.	Issues conformity inspection request(s)/TIA, as applicable, for the special purpose modification.	10.33	3.00	3.50	2.67	2.17	2.17	2.40	Type Certificate: Restrict Cat (Modified Military Aircraft)
95.	Issues letter of design approval based on establishing identifiability of design.	10.21	3.00	3.25	2.36	2.71	1.93	1.88	PMA Letter of Approval
96.	Participates as a member of a team in a QASAR audit, when requested.	9.86	2.86**	3.00	2.43	1.86	2.29	2.00	QASAR Audit
97.	Discusses flight test results during post-flight debriefing.	9.63	2.87	3.20	2.25	2.75	2.50	2.00	Type Certificate: Domestic

** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

TABLE 2-4

**AOC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (Continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG SUPVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG SUPVR</u>	<u>PRODUCT</u>
98.	Prepares and coordinates certification program notification.	9.50	2.80 3.00	2.00	3.30	1.70	1.57
99.	Monitors the effectiveness of airworthiness directive.	9.50	3.10*	3.86	2.30	2.10	1.80
100.	Reviews and comments on proposed advisory circular.	9.47	2.93	3.25	2.47	1.87	1.80
101.	Provides technical assistance as requested, in support of MIDO enforcement actions.	9.44	3.00	3.14	2.44	1.67	2.33
102.	Reviews and makes recommendations as required on flight manual supplements for engineering approval, when requested.	9.36	2.82** 3.14	2.27	2.18	2.10	2.43
103.	Serves in an advisory capacity to manufacturing inspection personnel during their surveillance of a product/manufacturing facility.	9.00	2.70	2.71	2.40	2.00	2.30
						2.14	Surveillance of Prod Approval
104.	Participates in technical societies or community organization conferences/meetings.	8.88	2.75	2.80	2.38	2.25	2.13
105.	Participates as member of National Aviation Safety Inspection program (NASIP) team, when requested.	8.83	2.83	3.67	2.50	1.33	1.67
106.	Interfaces with Aircraft Evaluation Group (AEG) during the certification process.	8.82	2.73	3.00	2.55	1.64	2.00
107.	Investigates and evaluates requests for technical assistance from the Office of Flight Standards and initiates appropriate action.	8.70	3.10	3.17	2.10	2.10	2.33
108.	Evaluates and processes FOIA requests.	8.10	2.60	3.14	2.40	1.70	1.60
109.	Participates in pre-flight briefing.	8.00	2.83	3.00	2.17	2.00	2.00
							Type Certificate: Domestic

* Engineers' mean rating significantly different from supervisors' mean rating (based on two-tailed t-test for independent samples with a p = .05).

** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

TABLE 2-4

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY OVER 25% OF SURVEY RESPONDENTS (Continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG</u>	<u>IMPORTANCE SUPVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG</u>	<u>TRAINING NEED SUPVR</u>	<u>PRODUCT</u>
The following tasks were added on the recommendation of the task validation panels:									
	Evaluates applicant's software program.	-	-	-	-	-	-	-	Type Certification: Domestic
	Verifies eligibility of PMA part for installation on product.	-	-	-	-	-	-	-	PMA Letter of Approval
	Evaluates applicant's data for identifiability to approved TC data.	-	-	-	-	-	-	-	PMA Letter of Approval

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

Introduction This section addresses the KSA component of the competency-based model by describing the knowledges, skills, and abilities (KSA's) required of mechanical-environmental systems engineers for successful performance of their tasks. Knowledge refers to an organized body of information, usually of a factual or procedural nature. Skill refers to the manual, verbal, or mental manipulation of data, people, or things. Skills are observable, quantifiable, and measurable. Ability refers to the capacity to perform an activity. The KSA information answers the following six questions:

1. What are the KSA's required for successful job performance?
 2. What is the relative importance of each KSA to successful job performance?
 3. What KSA's are required for each of the most critical job tasks?
 4. What is the definition and specific content for each KSA?
 5. How is proficiency in each KSA demonstrated in performing the critical job tasks?
 6. What training and development experiences support the development of proficiency in a KSA?
-

KSA's Required Early in the job task analysis panel process, specialists made a preliminary assessment of KSA's they need to do their jobs. Panelists identified KSA's for their specialty in three categories: technical knowledges, FAA-industry knowledges, and skills/abilities.

- o **Technical knowledges** were defined as the purely technical information that specialists need to accomplish their work. The technical knowledges are different for each specialty group and are comprehensive, representing the full range of knowledge required to accomplish all of the tasks within a specialty.

Continued . . .

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

KSA's Required (Continued)

- o The **FAA-industry knowledges** are mostly generic and are shared by many specialty groups. They represent knowledges specialists must possess concerning FAA/ACRP policies and procedures, the present state of domestic and international aviation, regulatory requirements, and other subjects of a non-technical nature that directly support successful task accomplishment.
 - o **Skills/abilities** are those skills that specialists must possess in order to work productively and effectively with others in the FAA, in industry, in government, and in the many agencies affected by the Aircraft Certification Regulatory Program. The skills/abilities are also general in nature, and all specialists within the ACRP possess them in varying degrees.
-

Importance Ratings For KSA's

The preliminary list of KSA's was incorporated into the ACRP Task Questionnaire to develop an initial picture of how important each KSA is to successful job performance. Supervisors also rated the KSA's to allow a comparison of employee and supervisory perspectives. Respondents rated each KSA on the five-point scale below.

RATING	IMPORTANCE
1.	KSA is <u>not important</u> for successfully performing your job.
2.	KSA has <u>minor or incidental importance</u> for successfully performing your job. It is not essential to whole job performance, but may be useful in performing a minor part of your job.
3.	KSA is <u>moderately important</u> for successfully performing either your whole job or some relatively major part of your job.
4.	KSA is <u>very important</u> for successfully performing either your whole job or a significant part of your job.
5.	KSA is one of the <u>most important</u> factors for successfully performing your job. It is important for your whole job or the most significant parts of your job.

Continued . . .

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

Importance Ratings For KSA's (Continued)

While the survey was in the field, additional panels met to develop specific definitions of each KSA. As anticipated, some KSA's were refined, modified, combined with others, or deleted. The final set of KSA's and importance ratings for mechanical-environmental systems engineers is presented in Table 3-1 below.

Most of these KSA's are as they originally appeared in the ACRP Task Questionnaire; some KSA's were substantially revised (or added) during subsequent panels. The original KSA's and those that were modified only slightly are listed in order of mean importance ratings provided by responding engineers. Supervisors' mean importance ratings are also presented; there were no significant differences between engineers' and supervisors' ratings (based on two-tailed t-tests for independent samples). KSA's that changed substantially during the panels are also listed, but without importance ratings. They are not listed in any particular order, nor should they be construed as less important than the KSA's with scores.

Table 3-1
Summary List of KSA's

<u>Technical Knowledges</u>	<u>Mean Importance Rating*</u>	<u>Engineers</u>	<u>Supervisors</u>
Basic engineering principles	4.17	4.50	
Pressurization systems	4.11	4.13	
Hydraulic systems	4.06	4.38	
Oxygen and protective breathing systems	4.06	4.25	
Wheels, tires, brake systems	4.06	4.00	
Pneumatic systems	4.00	4.00	
Air conditioning and heating	3.89	3.88	
Fire protection systems (detection and extinguishment)	3.83	4.25	
Powered flight controls	3.72	4.63	
Airframe icing protection	3.72	4.38	
Passenger safety and crashworthiness	3.72	3.63	
Rain removal/defogging systems	3.11	3.38	

* Importance scale ranged from 1 to 5. Refer to page 3-2 for description of scale.

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

<u>Technical Knowledges</u> (Continued)	<u>Mean Importance Rating</u>	<u>Engineers</u>	<u>Supervisors</u>
Cooling/heating systems for electrical/ electronic equipment	3.11	3.13	
Potable and waste water systems (large airplanes only)	2.94	2.63	
Cargo handling systems (large airplanes only)	2.78	2.25	
Ozone protection system (large airplanes only)	2.61	3.13	
Equipment with high-energy rotors	-	-	
General knowledge of the functions of aircraft systems, systems interface, and critical components of each system (project managers only)	5.00	N/A	
<u>FAA-Industry Knowledges</u>	<u>Mean Importance Rating</u>	<u>Engineers</u>	<u>Supervisors</u>
FAA and ACRP mission, regulations, policies, and procedures pertaining to certification of aeronautical products	4.35	4.38	
Government and industry standards	3.56	3.75	
Drawing systems and standards	3.18	3.00	
Aircraft operations and maintenance procedures	3.18	3.25	
Foreign airworthiness regulations and bilateral agreements	3.00	2.75	
FAA functional relationships with aircraft manufacturers, FCAA's, aviation associations, and professional societies	2.82	3.00	
Manufacturer's publications	-	-	
FAA organization structures, functions, relationships, practices, and resources available for technical support and training	-	-	
<u>Skills/Abilities</u>	<u>Mean Importance Rating</u>	<u>Engineers</u>	<u>Supervisors</u>
Skill in applying the FAR	4.56	4.75	
Communication skills	4.28	4.13	
Human relations skills	4.00	4.00	
Project management and team leadership skills	3.94	4.25	
Personal management of time and workload	3.83	4.25	
Office automation and basic computer skills	2.50	2.63	
Analytical ability in problem solving	-	-	

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

KSA-Task Linkage While this section has described the importance of KSA's for successful performance of job tasks, no direct relationship between critical job tasks and KSA's has been established. Establishing a direct linkage between tasks and KSA's has two important purposes:

- o It verifies the job relatedness of the KSA's by associating the KSA's to specific job requirements.
- o It allows finer discriminations regarding the identification of job requirements for selection procedures, including selection for employment, promotion, and training.

To identify the relationship between job tasks and KSA's, panelists completed a matrix which listed the highest-rated job critical tasks and the KSA's for their specialty group. For each task, panelists were asked to check the KSA's that are essential for successful task performance. While this initial matching needs further validation, it does provide a preliminary link between the job critical tasks and KSA's. A summary of the task and KSA linkages for ACO mechanical-environmental systems engineers is in Appendix B.

So far, the job criticality of tasks, the importance ratings of KSA's, and a first-cut at linking tasks and KSA's have been discussed. Next to be covered are examples of proficiency in a KSA and the training needed to attain a certain level of proficiency.

**KSA Proficiencies
and Training
Requirements**

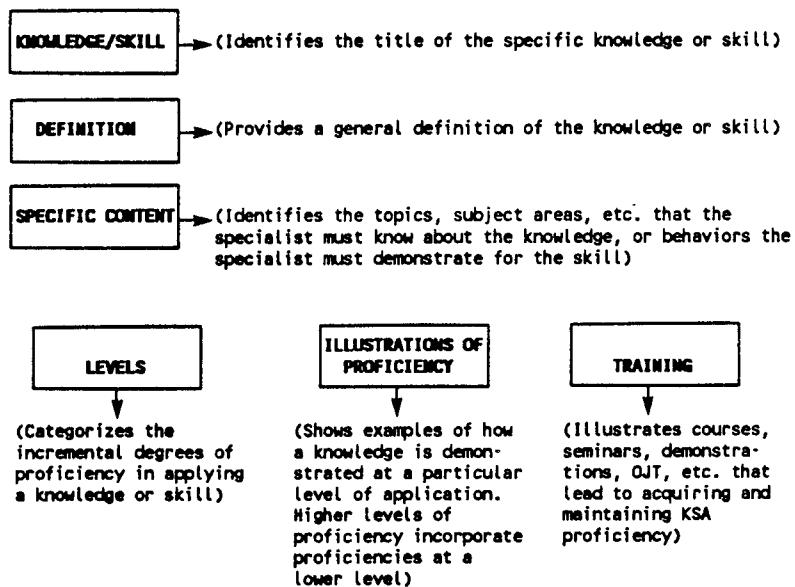
The last part of the KSA information collected describes how mechanical-environmental systems engineers demonstrate proficiency in each KSA and illustrates the type of training and development experiences that are needed to achieve and maintain proficiency at a particular level (i.e., basic or advanced). This information will be very useful in establishing a systematic training and development program for all ACRP specialists. The material that follows pulls together a variety of information for fully defining a KSA and for establishing needed training programs. The data are organized as shown on the following model.

Continued . . .

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

KSA Proficiencies and Training Requirements (Continued)

FIGURE 3-1
ORGANIZATION OF KSA PROFICIENCY AND
TRAINING INFORMATION



A word about the "levels" of proficiency. Two levels are designated for illustrating proficiencies in a KSA: basic and advanced. These levels represent the span of activity within an organization. Accomplishment of any task requires a comprehension of knowledge at a certain level, if the task is to be successfully completed. For example, simple, straightforward tasks may require only a rudimentary understanding of a knowledge for successful completion (Basic Level). Other, more complicated tasks may require an in-depth understanding of a knowledge (Advanced Level).

The terms Basic and Advanced then represent the range of levels at which a knowledge is applied. And these applications are illustrated through the tasks or activities described in the Illustrations of Proficiency. In short, these activities demonstrate the level of one's knowledge.

Continued . . .

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

KSA Proficiencies and Training Requirements (Continued) It should also be noted that not all of the courses, seminars, etc. identified in the training column exist or are available. Panelists may have recommended a course or subject for training that may not exist but perhaps should. At the end of this section is KSA proficiency and training information for all KSA's identified for mechanical-environmental systems engineers. Note that the specific content greatly expands on the general definition by identifying areas of involvement for the specialist. These areas also tend to appear in the illustrations of proficiency when specific examples of proficiency in the knowledge are cited. Proficiencies at the advanced level include basic level proficiencies. Likewise, training for making advanced applications assumes completion of training for basic applications.

Organization of KSA Proficiency and Training Information

KSA proficiency and training requirements information on the knowledges and skills for ACO mechanical-environmental systems engineers is organized as shown below. Basic engineering principles are acquired prior to, and are a basic requirement for, entry into the aerospace engineer position in the ACRP. Continued development of these principles is reflected throughout the other technical knowledges; thus, proficiency and training information has not been separately developed for this knowledge.

TECHNICAL KNOWLEDGES	PAGE
Pressurization systems	3-10
Hydraulic systems	3-12
Oxygen and protective breathing systems	3-14
Wheels, tires, brake systems	3-16
Pneumatic systems	3-18
Air conditioning and heating	3-19
Fire protection systems (detection and extinguishment)	3-21
Powered flight controls	3-23
Airframe icing protection	3-25
Passenger safety and crashworthiness	3-27
Rain removal/defogging systems	3-29
Cooling/heating systems for electrical/electronic equipment	3-30

Continued . . .

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

**Organization of
KSA Proficiency
and Training
Information
(Continued)**

TECHNICAL KNOWLEDGES	PAGE
Potable and waste waster systems (large airplanes only)	3-32
Cargo handling systems (large airplanes only)	3-34
Ozone protection system (large airplanes only)	3-36
Equipment with high-energy rotors	3-37
General knowledge of the functions of aircraft systems, systems interface, and critical components of each system (project managers only)	3-39
FAA/INDUSTRY KNOWLEDGES	
FAA and ACRP mission, regulations, policies, and procedures pertaining to certification of aeronautical products	3-40
Government and industry standards	3-42
Drawing systems and standards	3-43
Aircraft operations and maintenance procedures	3-45
Foreign airworthiness regulations and bilateral agreements	3-46
FAA functional relationships with aircraft manufacturers, FCAA's, aviation associations, and professional societies	3-48
Manufacturer's publications	3-50
FAA organization structures, functions, relationships, practices, and resources available for technical support and training	3-51
SKILLS/ABILITIES	
Skill in applying the FAR	3-53
Communication skills	3-55
Human relations skills	3-57
Project management and team leadership skills	3-59
Personal management of time and workload	3-61
Office automation and basic computer skills	3-62
Analytical ability in problem solving	3-63

SECTION 3 - SUMMARY OF KNOWLEDGE, SKILL, AND ABILITY INFORMATION

**Special Note:
Engineers'
Technical
Knowledges**

The technical knowledge information in the following proficiency and training requirements sheets should be viewed with an understanding of how the technical knowledges of a mechanical-environmental systems engineer are shaped by the demands of the Aircraft Certification Regulatory Program. The information represents the total, collective body of technical knowledge required by mechanical-environmental systems engineers to fulfill their ACRP mission. However, because of the wide nature of knowledge and expertise required to understand and evaluate aircraft design, no one engineer is expected to have all the necessary knowledge for a comprehensive evaluation of an aircraft. ACO certification engineers have a set of technical knowledges that are unique for their specialty. Likewise, each engineer within the specialty has his or her own unique set of technical knowledges. The engineer may have an in-depth understanding of a few technical knowledges, a passing familiarity with others, and no understanding of still others. As a result, no correlation between grade level and proficiency in demonstrating a knowledge can be made. It is not realistic to say that all GS-13 journeyman engineers will be able to make advanced applications of all required technical knowledges. In fact, an experienced ACO certification engineer, at the GS-13 level, may only be able to make basic applications of a technical knowledge because his or her understanding of it is slight. Thus, the typical journeyman engineer will demonstrate advanced proficiency, in some combination, but not all, of the technical knowledges.

As a result of the "individual profiles" of engineers there is emphasis on team work in the management of aircraft certification projects. Each branch within an ACO is comprised of a team of engineers, and, as a team, they rely on each other's technical knowledges to correctly evaluate certification requests. The principle is this: the combined knowledge of the group will provide the collective expertise for handling technical issues. Since it is unrealistic to expect an engineer to be highly proficient and knowledgeable in all technical knowledges, supervisors and managers try to ensure that the "organization" collectively possesses the full range of knowledge and expertise needed for performance of the full range of tasks. These considerations play a significant role in shaping supervisors' and managers' concerns and strategies related to recruiting, selecting, and developing the engineering expertise required by the organization.

AOC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Pressurization Systems	Definition:	Knowledge related to the system design for controlling cabin altitude and cabin pressure differentials with changes in aircraft altitude	
Specific Content:	Digital control technology, outflow valves (actuation and mechanization), overpressure relief valves, negative pressure relief valves, emergency procedures (emergency descent techniques), pressure equalization methods (blow-out panels, etc.), air conditioning system operation, supply and distribution compartment sealing techniques, external door pressurization interlock, systems analysis (function and failure modes)	Level's of Application	Illustrations of Proficiency	Training
Basic - ACO Engineer	Witnesses and documents system level tests in accordance with approved test plan.		Participates in and documents TIA functional flight tests (e.g., test of pressurization system).	Aircraft familiarization course (model/type) conducted by manufacturer
	Determines that construction and function of component complies with predetermined specification.		Determines that pressurization supply source is of adequate capacity to pressurize the aircraft cabin space under normal operating conditions.	OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer
	Reviews basic drawings for component part number and correct location (e.g., fuselage station, butt line, water line), on the aircraft.			
Advanced - ACO Engineer	Reviews and approves pressurization system design and performance to meet FAR requirements under critical system failure conditions.		Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for pressurization systems (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination).	Accident-incident investigation course Microprocessor system design course Non-destructive testing course

Levels of Application**Illustrations of Proficiency****Training**

Advanced - ACO Engineer (Continued)	<p>Determines positive and negative pressure relief capacity and design provisions are compatible with pressure vessel limit and ultimate structural requirements and fatigue considerations.</p> <p>Participates as accident/incident team member investigating cause of full open outflow valve depressurization incident.</p> <p>Evaluates criticality of pressure vessel failure in relation to pressurization system's capability to ensure compliance with cabin altitude limits and aircraft controllability requirements.</p> <p>Determines that the entire pressurization system of aircraft has the redundancy to provide a reasonable probability of safe operation during all phases of flight.</p> <p>Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).</p> <p>Evaluates adequacy of AFM emergency procedures.</p> <p>Evaluates degraded operational modes after failure and determines extent and acceptance of aircraft's level of operation.</p>	<p>Review regulatory precedents; attend presentation at FAA technical symposiums</p> <p>Fracture mechanics and damage tolerance seminar (presented by NTSB)*</p> <p>Damage tolerance analysis of aircraft structure course*</p> <p>Lightning protection for aircraft course*</p> <p>Software requirements and specifications course*</p> <p>Software verification and validation course*</p> <p>Design of digital control systems course*</p>
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* Supplementary training

<u>Technical Knowledge:</u>	<u>Hydraulic Systems</u>	<u>Definition:</u> Knowledge related to the design and operation of supply and distribution systems, landing gear systems, flight controls, and other hydraulically operated systems	<u>Specific Content:</u> Hydraulics and hydraulic fluid properties, structural properties, pressure levels, hydraulic pumps, actuators, accumulators, valves, distribution systems, seals and seal characteristics, corrosion characteristics, fatigue properties, hydraulic systems analysis (function and failure modes), engine windmill characteristics, fluid quantity and temperature measuring technology, airplane flight control and flight dynamic theory
<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>	
Basic - ACO Engineer	Determines that hydraulic component test results meet previously approved test plan (e.g., burst, proof pressure, environmental tests). Reviews schematic of hydraulic system for completeness (i.e., to ensure that adequate installation data for each component are included).	Reliability, probability, and safety analysis course Aircraft familiarization course (model/type) conducted by manufacturer	
	Witnesses and documents testing of simple components that failed (e.g., actuator, check valve, line fitting, pump, reservoir, accumulator). Determines that fluid properties are compatible with system components and seals and with system performance under normal operation.	OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer	
Advanced - ACO Engineer	Reviews and approves hydraulic system schematic to ensure all necessary components are included in the system. Evaluates system design to ensure proper sizing of hydraulic components to achieve the desired response (e.g., force, time, rate).	Accident-incident investigation course Microprocessor system design course Non-destructive testing course	
	Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for hydraulic systems (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination).	OJT: Review regulatory precedents; attend presentation at FAA technical symposiums	

Levels of Application**Illustrations of Proficiency****Training**

Advanced - ACO Engineer (Continued)	Reviews and approves hydraulic system analyses to ensure all possible failure modes are considered including combined failure modes (e.g., hydraulic fluid property changes under failure conditions, flammability of fluids, fire protection, system isolation).	Fracture mechanics and damage tolerance seminar (presented by NRS)* Basic metallurgy course*
	Analyzes failed hydraulic components to identify failure modes in order to determine proper corrective action.	Fundamentals of flight control theory course*
	Reviews and approves major hydraulic component and system test plans (e.g., temperature survey, endurance, transient pressure).	Active control technology and airborne systems course*
	Witnesses proof and operations test on complete hydraulic system as installed on an aircraft.	Lightning protection for aircraft course*
	Reviews and recommends criteria for continued airworthiness of certification maintenance requirements, if appropriate.	Airplane flight dynamics course*
	Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).	Software requirements and specifications course*
	Evaluates adequacy of AFM emergency procedures.	Software verification and validation course*
	Evaluates degraded operational modes after failure and determines extent and acceptance of aircraft's level of operation.	Design of digital control systems course*

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Oxygen and Protective Breathing Systems	Definition:	Knowledge related to the design and performance of oxygen supply equipment or protective breathing equipment for crew and passengers under normal conditions and during emergency situations	Specific Content:	Oxygen: Human physiological needs of oxygen, materials/design techniques used to prevent hazardous escape of oxygen (e.g., tanks, valves, lines, masks), quantities required for unpressurized/pressurized aircraft (descent profile/long range over water), types of masks (continuous flow, demand, etc.), supply systems (liquid, gaseous, chemical), distribution systems (crew passenger, therapeutic), mask donning procedures, TSO standards, systems analysis (function and failure modes)	Protective Breathing:	Design of masks/goggles and their use, human physiological needs of oxygen, compartmentalization requirements, TSO standards
Levels of Application							
		Basic - ACO Engineer	Illustrations of Proficiency	Training			
3			Reviews TSO application data (e.g., on oxygen components and protective breathing equipment) for compliance with FAR requirements.	Reliability, probability, and safety analysis course	Reviews the integrity of the installed system (e.g., flow rates, distribution, component qualification) to ensure proper functioning.	Aircraft familiarization course (model/type) conducted by manufacturer	Witnesses functional tests (e.g., drop tests on oxygen system) in accordance with previously approved test plan/procedures.
			Determines mask-goggle compatibility in accordance with FAA approved test data supplied by CAMI.	OUT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer	Reviews and approves protective breathing equipment's location and installation on airplane as specified in FAR.		

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Advanced - ACO Engineer	<p>Reviews airplane mission requirements (i.e., number of passengers, flight profiles, emergency descent) to determine that oxygen system has the capability to meet minimum FAA requirements.</p> <p>Reviews oxygen system to determine that it meets human physiological needs for the approved operating envelope of the aircraft.</p> <p>Reviews installation of oxygen system in relation to other systems (e.g., hydraulics, electrical, fire zones) to ensure proper isolation and separation.</p> <p>Evaluates compliance of single breathing apparatus proposed for multiple uses, such as sustenance, protective breathing, therapeutic, flight attendant portable oxygen.</p> <p>Reviews and approves qualification tests requirements for protective breathing apparatus as part of type certification requirements for installation in aircraft.</p> <p>Determines need for and scope of technical support from other specialists (e.g., inspector/engineer participation).</p> <p>Evaluates adequacy of AFM emergency procedures.</p>	<p>Accident- incident investigation course</p> <p>Microprocessor system design course</p> <p>Non-destructive testing course</p> <p>OJI: Review regulatory precedents; attend presentation at FAA technical symposiums</p> <p>Composite material course*</p> <p>Basic metallurgy course*</p> <p>Design with polymers and composites course*</p> <p>Lightning protection for aircraft course*</p> <p>Physiological training</p>
Intermediate - ACO Engineer	<p>Reviews airplane mission requirements (i.e., number of passengers, flight profiles, emergency descent) to determine that oxygen system has the capability to meet minimum FAA requirements.</p> <p>Reviews oxygen system to determine that it meets human physiological needs for the approved operating envelope of the aircraft.</p> <p>Reviews installation of oxygen system in relation to other systems (e.g., hydraulics, electrical, fire zones) to ensure proper isolation and separation.</p> <p>Evaluates compliance of single breathing apparatus proposed for multiple uses, such as sustenance, protective breathing, therapeutic, flight attendant portable oxygen.</p> <p>Reviews and approves qualification tests requirements for protective breathing apparatus as part of type certification requirements for installation in aircraft.</p> <p>Determines need for and scope of technical support from other specialists (e.g., inspector/engineer participation).</p> <p>Evaluates adequacy of AFM emergency procedures.</p>	<p>Accident- incident investigation course</p> <p>Microprocessor system design course</p> <p>Non-destructive testing course</p> <p>OJI: Review regulatory precedents; attend presentation at FAA technical symposiums</p> <p>Composite material course*</p> <p>Basic metallurgy course*</p> <p>Design with polymers and composites course*</p> <p>Lightning protection for aircraft course*</p> <p>Physiological training</p>
Entry Level - ACO Engineer	<p>Reviews airplane mission requirements (i.e., number of passengers, flight profiles, emergency descent) to determine that oxygen system has the capability to meet minimum FAA requirements.</p> <p>Reviews oxygen system to determine that it meets human physiological needs for the approved operating envelope of the aircraft.</p> <p>Reviews installation of oxygen system in relation to other systems (e.g., hydraulics, electrical, fire zones) to ensure proper isolation and separation.</p> <p>Evaluates compliance of single breathing apparatus proposed for multiple uses, such as sustenance, protective breathing, therapeutic, flight attendant portable oxygen.</p> <p>Reviews and approves qualification tests requirements for protective breathing apparatus as part of type certification requirements for installation in aircraft.</p> <p>Determines need for and scope of technical support from other specialists (e.g., inspector/engineer participation).</p> <p>Evaluates adequacy of AFM emergency procedures.</p>	<p>Accident- incident investigation course</p> <p>Microprocessor system design course</p> <p>Non-destructive testing course</p> <p>OJI: Review regulatory precedents; attend presentation at FAA technical symposiums</p> <p>Composite material course*</p> <p>Basic metallurgy course*</p> <p>Design with polymers and composites course*</p> <p>Lightning protection for aircraft course*</p> <p>Physiological training</p>

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Wheels, Tires, Brake Systems	Definition:	Knowledge related to the design and performance of wheels, tires, and brakes on aircraft	Specific Content:	Structural analysis, material properties, thermodynamic properties (heat transfer and heat dissipation), auto-brake systems, anti-skid systems, brake lining properties (steel/carbon brakes), fuse-plugs, radial and bias ply tires, tire construction, dynamometer testing, certification testing policy (e.g., aborted takeoffs), accumulator properties, TSO standards, hydraulic applications to brake systems, parking brakes, emergency brakes, tire pressure indicating system, brake temperature monitoring system, systems analysis (function and failure modes), rejected takeoff brake testing procedure
Levels of Application		Illustrations of Proficiency		Training	
Basic - ACO Engineer	Determines that the load/speed ratings of the tire and wheel are not exceeded given the maximum gross weight of the aircraft and center of gravity requirements.	Determines that the kinetic energy rating of brakes is compatible with the proposed kinetic energy capacity for the aircraft.	Witnesses tests required to show compliance with the appropriate FAR (e.g., RTO, spray tests) in accordance with previously approved test plans.	Aircraft familiarization course (model/type) conducted by manufacturer	Reliability, probability, and safety analysis course
Advanced - ACO Engineer	Determines the scope and content of brake system flight test requirements with applicant and flight test personnel for inclusion in TIA.	Determines complex certification requirements (e.g., for approving replacement of wheels, tires, and brakes and for verifying the adequacy of proposed brake wear limits).	Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for wheels, tires, and brakes (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination).	OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer	Accident/incident investigation course Microprocessor system design course Non-destructive testing course Review regulatory precedents; attend presentation at FAA technical symposiums

Levels of Application

Illustrations of Proficiency

Training

<u>Advanced - ACO Engineer (Continued)</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
	Reviews and approves the aircraft manufacturer's assumptions and parameters that are part of the rational analysis for calculating the maximum kinetic energy design requirements for the aircraft.	Basic metallurgy course*
	Reviews the interrelationship of wheels, tires, and brake systems with electrical, hydraulic, and pneumatic systems (e.g., anti-skid, auto-brakes, emergency brakes, tire pressure indicators, brake temperature monitoring, brake-by-wire) for compatibility and compliance with applicable FAR.	Damage tolerance analysis of aircraft structure course*
	Reviews the design characteristics of complex wheel, tire, and brake assemblies for their installation effects on the aircraft (e.g., effect of moving resistance of tires, impact of dragging brake, effect of retraction time).	Lightning protection for aircraft course*
	Reviews and recommends criteria for continued airworthiness of certification maintenance requirements, if appropriate.	Software requirements and specifications course*
	Evaluates the adequacy and completeness of failure modes analysis on wheels, tires, and brake systems for compliance with FAR (e.g., anti-skid, auto-brake, brake-by-wire).	Software verification and validation course*
	Resolves service difficulty problems associated with wheels, tires, and brakes identified on domestic aircraft, or through an accident/incident.	Design of digital control systems course*
	Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation). Fracture mechanics and damage tolerance seminar (presented by NTS)*	

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Pneumatic Systems	Definition:	Knowledge related to generation, control, distribution of "bleed" air; high pressure nitrogen systems for use in emergency egress and flotation (storage, activation and distribution); vacuum systems	Specific Content:	Engine bleed systems, pneumatic control systems (pressure and temperature), heat exchangers, temperature transducers, pressure transducers, microprocessors, pneumatic distribution systems, pneumatic system users (anti-icing/de-icing, starters, motors, activators), proof/burst test procedures, motor-operated valves, pressure operated valves (control valves), flotation devices, life rafts, slides, autopilot systems, vacuum pumps, vacuum instruments, systems analysis (function and failure modes)
Levels of Application	Illustrations of Proficiency	Training			
Basic - ACO Engineer	Determines that pneumatic component test results meet previously approved test plan (e.g., burst, proof pressure, environmental tests). Reviews simple schematic of pneumatic system to ensure that adequate installation data for each component are included.	Reliability, probability, and safety analysis course	Aircraft familiarization course (model/type) conducted by manufacturer	OJT: Assist experienced engineer in making compliance findings; attend staff technical presentations; interact with DER; view GBI videotapes/software from manufacturer	
Advanced - ACO Engineer	Reviews and approves complex pneumatic system schematic to ensure all necessary components are included in the system. Evaluates system design to ensure proper sizing of pneumatic components to achieve required pressure, temperature, and flow rates. Reviews and approves pneumatic system analyses to ensure all possible failure modes are considered including combined failure modes (e.g., system isolation, bleed air contamination, overtemperature, overpressure).	Accident-incident investigation course Microprocessor system design course	Non-destructive testing course	OJT: Review regulatory precedents; attend presentation at FAA technical symposiums	* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Air Conditioning and Heating	Definition:	Knowledge related to the design and performance of aircraft heating and cooling systems (e.g., heat loss, air distribution and ventilation requirements)	Specific Content:	Types of heating and air conditioning equipment and their integration into aircraft systems, aircraft ducting systems (construction and routing), airflow pressure drop characteristics, specific ventilation requirements for crew and passengers, bleed air quality (normal and malfunction), systems analysis (function and failure mode), test requirements for CO₂ contamination
Levels of Application	Illustrations of Proficiency				
Basic - ACO Engineer	Training				
	Determines that individual air conditioning components qualification test results meet previously approved test plans (e.g., air cycle machines, ducts, proof pressure, environmental).	Witnesses ground and flight tests in accordance with previously approved test plans to determine proper system operation (e.g., minimum air flow, CO/CO ₂ concentration, temperature control in individual compartments, etc.).	Reviews simple schematic of air conditioning system to ensure that adequate installation data for each component are included.	Reviews and approves air conditioning system schematic and system analysis to ensure all necessary components are included and proper air flow and temperature control are provided.	Reviews and approves combustion heaters and engine exhaust heaters as applicable.
Advanced - ACO Engineer	Reviews and approves qualification test plans for each individual component.	Reviews and approves qualification test plans for each individual component.	Reviews and approves combustion heaters and engine exhaust heaters as applicable.	Reviews and approves air conditioning system failure analysis to ensure all possible failure modes, including combined failures, are considered (e.g., ACM, valves, ducts, sensors).	Fracture mechanics and related damage tolerance seminar (presented by NIRS)*

* Supplementary training

Levels of Application

Illustrations of Proficiency

Training

Advanced - ACO Engineer
(Continued)

Reviews and approves air conditioning test plans (e.g., to demonstrate proper CO/CO₂ concentrations, temperature controls, water separation).

Analyzes failed air conditioning components to identify failure modes in order to determine proper corrective action.

Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for air conditioning and heating systems (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination).

Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).

Composite material course*

Design with polymers and composites course*

Software requirements and specifications course*

Software verification and validation course*

Design of digital control systems course*

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

<u>Technical Knowledge:</u>	<u>Fire Protection Systems (detection and extinguishment)</u>	<u>Definition:</u>	<u>Knowledge related to design and performance of fire detection and extinguishing systems</u>
<u>Specific Content:</u>	<p>Classification of cargo compartments, smoke detection systems, fire (temperature) detection systems, automatic extinguisher systems, use of smothering for Class D compartments, compartment leakage rate testing, smoke penetration/evacuation policy and testing, nature of extinguishing agents, measurement of extinguishment concentration, concentration policy, gas distribution systems (e.g., metered halon), pressure vessels, squibs (pyrotechnic device), TSO standards, systems analysis (function and failure modes), air flow control for cargo smoke/fire protection, liner materials</p>		
<u>Level of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>	
Basic - ACO Engineer	<p>Reviews and evaluates classification of cargo compartments and selection of appropriate detection/extinguishing means for compliance with FAR.</p> <p>Reviews and evaluates system capacity proposal for compliance with FAR.</p> <p>Conducts a FAR compliance inspection (e.g., inspects portable fire extinguishers - number and type).</p> <p>Witnesses accomplishment and documents results of test conducted in accordance with previously approved test plan for fire protection system.</p> <p>Reviews fire protection system schematic to ensure that it includes adequate installation data for each component (e.g., smoke detectors, communicators, extinguishers, fire detectors, distribution systems).</p>	<p>Aircraft familiarization course (model/type) conducted by manufacturer</p> <p>OUT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer</p>	<p>Reliability, probability, and safety analysis course</p>
Advanced - ACO Engineer	<p>Reviews and approves test plan for complete fire protection system on an aircraft (e.g., smoke penetration, distribution and concentration of extinguishing agent).</p> <p>Approves the classification of compartments, selection of appropriate detection/extinguishing means, and agent capacity proposal for compliance with FAR.</p>	<p>Accident-incident investigation course</p> <p>Microprocessor system design course</p>	<p>Non-destructive testing course</p> <p>OUT: Review regulatory precedents; attend presentation at FAA technical symposiums</p>

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Advanced - ACO Engineer (Continued)	<p>Reviews and approves fire protection system analysis to ensure all possible failure modes are considered including combined failure modes.</p> <p>Reviews and approves fire protection system schematic to ensure all necessary components are included.</p> <p>Conducts a detailed FAR compliance inspection (e.g., to ensure necessary fire proof material or shielding provisions are included).</p> <p>Evaluates adequacy of proposed emergency procedures for inclusion in FAA approved aircraft flight manual.</p> <p>Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).</p>	<p>Software requirements and specifications course*</p> <p>Software verification and validation course*</p> <p>Design of digital control systems course*</p>

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Powered Flight Controls	Definition:	Knowledge related to aircraft flight load characteristics, structural responses, and the design and performance of electrical, mechanical, pneumatic, and hydraulic components	Specific Content:	Aircraft responses to control surface movements, inputs required to move control surfaces, active control system, stability augmentation system, mechanization of control systems, interface of actuators/servomechanisms with mechanical controls, structural strength requirements, sensors, position indicators, amplifiers, controls, power requirements, computer technology-functional aspects, fly-by-wire/fly-by-light control aspects, system analysis (function and failure modes)
Levels of Application	Illustrations of Proficiency	Training			
Basic - ACO Engineer	Determines that minimum designed burst and proof load requirements for actuators are met.	Reliability, probability, and safety analysis course			
	Verifies construction of individual components meets design requirements (e.g., materials, environmental operating conditions).	Aircraft familiarization course (model/type) conducted by manufacturer			
	Determines that component test result meets previously approved test plan/requirements.	OUT: Assist experienced engineer in making compliance findings; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer			
	Reviews simple schematic of flight control system to ensure that adequate installation data were included.				
	Witnesses and documents functional and dimensional check of a failed component due to accident/incident investigation.				
Advanced - ACO Engineer	Reviews and approves complex design for multiple hydraulic system control actuators (e.g., to assist airframe engineer in determining compliance with requirements of the controlled airframe flight surface freedom from flutter based on hydraulic dampening alone).	Accident-incident investigation course Microprocessor system design course			
	* Supplementary training				

Levels of ApplicationIllustrations of ProficiencyTraining

Advanced - ACO Engineer
(Continued)

Determines compliance with FAR for continued safe flight of all hydraulic powered flight control systems under combined failure conditions.

Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for powered flight controls (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination).

Reviews and approves autopilot-pilot interface with the hydraulic power packs (i.e., function and failure modes) to evaluate appropriate "level of authority" of the autopilot.

Analyzes the failure modes that can cause flap asymmetry.

Reviews and recommends criteria for continued airworthiness of certification maintenance requirements, if appropriate.

Reviews and approves systems schematic to ensure all necessary components are included (e.g., for hydraulic, pneumatic systems, etc.).

Reviews and approves complex systems analysis (e.g., to ensure all possible failure modes were considered).

Evaluates systems and FAR requirements for actuators and their servo controls to move the primary control surface.

Evaluates the potential for interaction of structural movement relative to the signal for servo valve actuation for proper feedback and control.

Reviews the aircraft hydraulic system to ensure proper sizing of actuators, pumps, and lines to achieve desired control movements relative to force, time, rate.

Analyzes failed component on hydraulic system to determine the mode of and reason for failure in order to determine proper corrective action.

Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).

Evaluates adequacy of proposed emergency procedures for inclusion in FAA-approved AFM.

Non-destructive testing course

QJT: Review regulatory precedents; attend presentation at FAA technical symposiums

Basic metallurgy course*

Damage tolerance analysis of aircraft structure course*

Fundamentals of flight control theory course*

Active control technology and airborne systems course*

Lightning protection for aircraft course*

Airplane flight dynamics course*

Software requirements and specifications course*

Software verification and validation course*

Design of digital control systems course*

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Airframe Icing Protection	Definition:	Knowledge related to the design and performance of equipment used in anti-icing and de-icing systems on aircraft
Specific Content:			Chemical properties (chemical de-icers), thermodynamic properties (thermal de-icers), electro-pneumatic design, boot properties, instrumentation design, pneumatic properties, icing properties, use of ice shapes for icing testing, dry air testing, ice accumulation techniques (natural/simulated icing test), ice detection techniques, electro-impulse techniques
Levels of Application:		Illustrations of Proficiency	Training
Basic - ACO Engineer		Verifies, given system tolerances, proper analysis techniques are used in the analyses submitted by the applicant for electrical/pneumatic heat systems, pneumatic boot systems, fluid systems, etc. Relates system design conditions to appropriate parts of FAR (e.g., the icing envelope).	Reliability, probability, and safety analysis course Aircraft familiarization course (model/type) conducted by manufacturer
3-25		Verifies, given tolerance requirements of test instrumentation, proper capability and sensitivity of icing instrumentation are adequate to record data from icing tests. Participates in TIA flight tests and witnesses component qualification tests.	OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer
		Reviews simple specifications and drawings for icing equipment and verifies equipment has been properly tested to function in aircraft operating environment.	Accident-incident investigation course
Advanced - ACO Engineer		Determines that test ice shapes duplicate shapes that are typical for the model aircraft in the FAR icing envelope.	Microprocessor system design course
		Reviews and approves applicant's system design criteria for determination of critical design conditions (e.g., altitude, temperature, liquid water content, droplet diameter) to cover the operating envelope of the aircraft.	Non-destructive testing course

Levels of Application

Illustrations of Proficiency

Training

Advanced - ACO Engineer
(Continued)

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| Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for icing protection systems (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination). | OJT: Review regulatory precedents; attend presentation at FAA technical symposiums |
| Evaluates and approves design conditions and environmental parameters for valid use of icing tunnel tests. | Fracture mechanics and damage tolerance seminar (presented by NRS)* |
| Provides examples of certification testing/applications to directorate regulation and guidance professionals concerning airframe icing certification procedures (e.g., for interface with FCAA, to develop AC). | Aircraft icing course* |
| Reviews anti-ice/de-ice equipment installation for safety aspects during normal and failure conditions. | Software requirements and specifications course* |
| Develops scope and content of icing certification TIA items with flight test personnel. | Software verification and validation course* |
| Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation). | Design of digital control systems course* |

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Passenger Safety and Crashworthiness	Definition:	Knowledge related to the design and installation of aircraft interior arrangements required for passenger survivability and evacuation in a crash and related safety equipment	Specific Content:	Minimum aisle widths for evacuation, emergency egress provisions, emergency egress lighting, load capacity to meet crash loading requirements, material flammability, fire blocking of seat cushions, evacuation demonstrations, protrusions which may cause passenger injury, TSO standards, systems analysis (as appropriate), required markings and placards
Levels of Application	Illustrations of Proficiency	Training			
Basic - ACO Engineer	Verifies that equipment (seats, seat belts, seat cushions, emergency lights, etc.) have been previously approved (TSO, PMA, etc.) and are installed in accordance with approved drawings.	Aircraft familiarization course (model/type) conducted by manufacturer	Reliability, probability, and safety analysis course		
	Witnesses and documents results of approved tests (e.g., interior material flammability fire containment, cargo liner flame penetration, emergency evacuation slide/slide raft tests, emergency lighting) conducted in accordance with approved test plans.	OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view instructional videotapes/software from manufacturer			
	Determines that analysis follows standard static/dynamic analytical techniques (e.g., analysis used to verify that installation of interior equipment complies with crash load requirements).				
	Witnesses and documents functional tests of failed interior equipment as part of accident/incident investigation.				
Advanced - ACO Engineer	Participates as team member in NTSB post accident/incident investigation concerning passenger/crew human factors and survivability.	Accident-incident investigation course			
	Reviews and approves full scale passenger emergency evacuation demonstration test plan, test, and analysis for compliance with FAR requirements (e.g., maximum capacity of passengers, exit flow rates, exit distribution location).	Microprocessor system design course			
		Non-destructive testing course			

Levels of ApplicationIllustrations of ProficiencyTraining

Advanced - ACO Engineer
(Continued)

Evaluates and recommends approval or denial of requests for equivalent level of safety findings (e.g., request relative to exit distribution, exit size).

Provides guidance to designated engineering representatives (DER's) relative to compliance with interior material flammability requirements and interior material flammability tests.

Conducts complete aircraft interior compliance inspection using crashworthiness checklist or applicable regulations for a specific aircraft (e.g., emergency lighting system, ditching equipment, seat belts, etc.).

Reviews and approves material flammability test plans for compliance with FAR requirements (e.g., cushion fire blocking, radiant heat release).

Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).

OJT: Review regulatory precedents; attend presentation at FAA technical symposiums

Composite material course*

Design with polymers and composites course*

Lightning protection to aircraft course*

* Supplementary training

<u>Technical Knowledge:</u>	<u>Rain Removal/Defogging Systems</u>	<u>Definition:</u>	Knowledge of the design and performance of rain removal/defogging systems
<u>Specific Content:</u>	Aircraft windshield wiper systems-electrical and hydraulic actuated; analysis of stroke and park positions for maintaining required visibility during rain operation; flow, pattern, and effectiveness of pneumatic and chemical rain removal systems; toxicity of repellent fluids; means to provide windshield and window panel defogging; system analysis (function and failure modes)		
<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>	
Basic - ACO Engineer	<p>Witnesses accomplishment and documents results of tests previously approved in the test plan.</p> <p>Reviews installation drawings to ensure that adequate installation data are included for rain removal and defogging components (e.g., motors, wipers, blades, pump, distribution systems, reservoir).</p>	<p>Reliability, probability, and safety analysis course</p> <p>Aircraft familiarization course (model/type) conducted by manufacturer</p> <p>OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer</p>	<p>Accident-incident investigation course</p> <p>Microprocessor system design course</p> <p>Non-destructive testing course</p> <p>OJT: Review regulatory precedents; attend presentation at FAA technical symposiums</p>
Advanced - ACO Engineer	<p>Reviews and approves rain removal and defogging system test plans (e.g., flow and pattern of pneumatic and chemical systems, chemical toxicity and corrosive characteristics).</p> <p>Reviews and approves the rain removal and defogging system analysis to ensure consideration of all possible failure modes, including combined failures.</p> <p>Develops and coordinates rain removal and defogging items for the TIA.</p> <p>Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).</p>		

Technical Knowledge:	Cooling/Heating Systems for Electrical/Electronic Equipment
Definition:	Knowledge related to the design and performance of cooling/heating systems that provide for operation of electrical/electronic equipment within specified temperature limits
Specific Content:	Equipment requiring heat/cool air, location of equipment and air distribution required, analysis of minimum air flow requirements for hot-day conditions (ground and flight), overboard ducting of air (if appropriate), smoke detection and evacuation system, systems analysis (function and failure modes), cockpit annunciation (if appropriate), temperature measurement techniques

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Basic - ACO Engineer	<p>Determines that individual electrical/electronic cooling system components meet previously approved test plans (e.g., fans, valves, ducts, smoke detectors).</p> <p>Witnesses ground and flight tests in accordance with previously approved test plans to determine proper system operation (e.g., temperature survey, overheat detection/correction, smoke detection/clearance procedures).</p> <p>Reviews simple schematic of electrical/electronic cooling system to ensure that adequate installation data for each component are included.</p>	<p>Reliability, probability, and safety analysis course</p> <p>Aircraft familiarization course (model/type) conducted by manufacturer</p> <p>OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer</p> <p>Accident/incident investigation course</p>
Advanced - ACO Engineer	<p>Reviews and approves complex electrical/electronic cooling system schematics to ensure all necessary components are included.</p> <p>Reviews and approves electrical/electronic cooling system analysis (e.g., to ensure each item of equipment requiring heating/cooling receives the proper airflow to maintain the desired temperature).</p> <p>Reviews and approves the electrical/electronic cooling system failure analysis to ensure all possible failure modes are considered (e.g., fans, valves, ducts, smoke detectors, loss of cooling) and evaluates the need for failure warning monitors.</p>	<p>Microprocessor system design course</p> <p>Non-destructive testing course</p> <p>OJT: Review regulatory precedents; attend presentation at FAA technical symposiums</p> <p>Lightning protection for aircraft course*</p>

* Supplementary training

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Advanced - ACO Engineer (Continued)	Analyzes failed components to identify failure modes in order to determine proper corrective action.	Software requirements and specifications course*
	Reviews and approves qualifying test plans for individual components of electrical/electronic system.	Software verification and validation course*
	Reviews and approves electrical/electronic cooling system test plans to demonstrate proper air flow, temperature distribution (temperature survey), smoke clearance, procedures, overheat detection/correction, hot-day ground test.	Design of digital control systems course*
	Evaluates hot-day ground test limits if additional equipment is added to electrical/electronic equipment way that requires cooling.	
	Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).	
	Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for cooling and heating of electrical/electronic equipment (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination).	

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Potable and Waste Water Systems (large airplanes only)	Definition:	Knowledge related to the design and installation of aircraft potable water storage, pressurization and distribution, and waste storage and disposal, including vacuum lavatory systems	Specific Content:	Types of stowage systems, total pressure or demand pressure, acceptable materials for storing and distributing potable water, extreme temperature protection, waste-storage and disposal equipment, acceptable materials for waste storage, acceptable disposal procedures and equipment, overboard drain mast (function and impingement pattern), systems analysis (function and failure modes)
<hr/>					
Levels of Application	Illustrations of Proficiency	Training			
Basic - ACO Engineer	<p>Verifies that potable and waste water system installation drawings are complete, meet FAR requirements and comply with standard engineering practices.</p> <p>Reviews design of potable and waste water system to ensure proper overpressure relief and overflow drainage are provided under normal system operating conditions.</p> <p>Reviews system design to ensure that materials (e.g., tubing, tanks, valves) are approved for use with potable water.</p> <p>Witnesses simple system/component functional tests and record results in accordance with previously approved test plans.</p>	<p>Reliability, probability, and safety analysis course</p> <p>Aircraft familiarization course (model/type) conducted by manufacturer</p> <p>OJT: Assist experienced engineer in making compliance findings; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer</p>	<p>Reviews and approves materials, equipment, and installation procedures for installation of potable and waste water system.</p> <p>Reviews and approves complete functional test plans (e.g., overpressure/fluid drainage - ground and flight, impingement patterns).</p>	<p>Accident incident investigation course</p> <p>Microprocessor system design course</p> <p>Non-destructive testing course</p>	

Levels of Application**Illustrations of Proficiency****Training**

Advanced - ACO Engineer (Continued)	Illustrations of Proficiency	Training
Evaluates potable and waste water fill and service design features (respectively) to ensure they do not promote fluid leakage while in-service which would cause damage to critical aircraft controls/systems.		Out: Review regulatory precedents; attend presentation at FAA technical symposiums
Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).	Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for potable and waste water systems (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination).	Course*: Composite material course* Design with polymers and composites course*

Software requirements and specifications course*

Design of digital control systems course*

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Cargo Handling Systems (large airplanes only)
Definition:	Knowledge of design and installation of cargo handling systems in cargo compartments of large airplanes
Specific Content:	Restraint systems, cargo fire protection, electrical power distribution philosophy (ground handling bus vs. in-flight power), motor-driven rollers, material flammability (for parts of system), belt systems (powered movers)
Level of Application	Illustrations of Proficiency
Basic - ACO Engineer	<p>Reviews TSO applications for completeness as specified in FAR (e.g., cargo container TSO, C-90).</p> <p>Determines that cargo loading placard as installed is visible and cannot be easily erased, disfigured, or discarded.</p> <p>Verifies that design and installation drawings comply with appropriate FAR requirements (e.g., attachment, routing, clearance, etc.).</p> <p>Witnesses previously approved qualification and functional tests of cargo handling components (e.g., motors, rollers, guides).</p>
Advanced - ACO Engineer	<p>Reviews drawings and inspects installation of cargo system to ensure essential controls, hydraulic lines, electrical systems cannot be damaged to prevent continued safe flight and landing of aircraft.</p> <p>Reviews cargo compartment design to ensure installation of cargo compartment liner, differential pressure valves, and access panels is done in a manner that maintains continued integrity of compartment isolation.</p> <p>Reviews design data to verify that basic components (electric and hydraulic motors) are adequate to safely move cargo, pallet loads (e.g., electrical bus loading and hydraulic fluid supply are adequate).</p> <p>Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).</p>
Training	
	<p>Reliability, probability, and safety analysis course</p> <p>Aircraft familiarization course (model/type) conducted by manufacturer</p> <p>OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer</p> <p>Accident/incident investigation course</p> <p>Microprocessor system design course</p> <p>Non-destructive testing course</p> <p>OJT: attend presentation at FAA technical symposiums</p>

Levels of Application

Advanced - ACO Engineer
(Continued)

Consults with component manufacturers regarding additional testing of cargo handling system components that have not been previously approved by the FAA.

Illustrations of Proficiency

Training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Ozone Protection System (large airplanes only)
Definition:	Knowledge of the design and performance of systems to limit the concentration of ozone in the occupied areas of large airplanes
Specific Content:	Ozone concentration characteristics, retention ratios and measurement techniques, cabin dissociation factors; catalytic converters, air conditioning systems, pressurization systems, physiological effects, systems analysis (function and failure modes)

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Basic - ACO Engineer	Witnesses accomplishment and documents results of approved test in accordance with previously approved test plan for ozone system.	Reliability, probability, and safety analysis course
	Reviews manufacturer's installation drawings to determine that data for installation of components (e.g., catalytic convert, ducts) are adequate.	Aircraft familiarization course (model/type) conducted by manufacturer
Advanced - ACO Engineer	Reviews and approves test plan or analysis to determine the adequacy of system and operating procedures to meet regulatory requirements (e.g., catalytic converter, "R" factor determination). Reviews and recommends criteria for continued airworthiness of certification maintenance requirements, if appropriate (e.g., life limits, periodic test). Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation).	OJT: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer Accident-incident investigation course Microprocessor system design course Non-destructive testing course OJT: Review regulatory precedents; attend presentation at FAA technical symposiums

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	Equipment with High-Energy Rotors
Definition:	Knowledge of the design and installation of equipment which operates with rotational energies high enough to pose a hazard to the aircraft or endanger occupants
Specific Content:	Air cycle machines, high speed fans, high speed pneumatic motors or turbines, destructive or non-destructive test techniques

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Basic - ACO Engineer	Witnesses system documents results in accordance with previously approved test plan (e.g., overspeed, overpressure, rotor containment, etc.). Ensures component installation is in accordance with standard engineering practices and FAA-approved drawings and installation procedures (e.g., for location and orientation of high energy rotor equipment).	Reliability, probability, and safety analysis course Aircraft familiarization course (model/type) conducted by manufacturer Q/T: Assist experienced engineer in making compliance finding; attend staff technical presentations; interact with DER; view CBI videotapes/software from manufacturer
Advanced - ACO Engineer	Reviews and approves system and component installation and required test plans for compliance to FAR (e.g., normal and failed conditions). Determines need for and scope of technical support from other ACRP specialists (e.g., inspector/engineer participation). Reviews the design of the equipment's overspeed control and the design of the complete system to ensure that operational limitations will not be exceeded or no hazardous malfunction will occur (e.g., location of affected equipment, shielding).	Accident-incident investigation course Microprocessor system design course Non-destructive testing course Q/T: Review regulatory precedents; attend presentation at FAA technical symposiums

Levels of ApplicationIllustrations of ProficiencyTraining

Advanced - ACO Engineer
(Continued)

Provides guidance to and supervision of DER with regard to interpretations of certification requirements and acceptable methods of compliance for equipment with high energy rotors (e.g., proposed test procedures, post review of DER-approved data, hazard analysis coordination).

Fracture mechanics and damage tolerance seminar (presented by NRS)*
Composite material course*

Basic metallurgy course*

Design with polymers and composites course*

Software requirements and specifications course*

Software verification and validation course*

Design of digital control systems course*

* Supplementary training

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Technical Knowledge:	General Knowledge of the Functions of Aircraft Systems, Systems Interface, and the Critical Components of Each System (Project Manager Only)
Definition:	Knowledge related to general development and design of aircraft, engines and propellers, aircraft systems and to the functions of major components within systems
Specific Content:	Aircraft preliminary design studies; aircraft engine and propeller design; aircraft systems design, components, design limitations; development and certification test procedures

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Advanced - ACO Engineer	<p>Determines interdisciplinary need for and utilizes appropriate specialists to resolve technical certification issues (e.g., develop new policy, draft special conditions, etc.).</p> <p>Ensures coordination of multidisciplinary technical issues and related correspondence with appropriate team members (e.g., avionics equipment that interfaces with propulsion system).</p> <p>Determines special attention items to review with applicant and coordinates technical aspects and involvement of appropriate specialists (e.g., critical tests, software verification and validation).</p>	Orientation program for project managers

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

FAA-Industry Knowledge:	FAA and ACRP Mission, Regulations, Policies, and Procedures Pertaining to Certification of Aeronautical Products
Definition:	Knowledge related to the purposes and functions of the FAA and ACRP and to aircraft certification regulations, policies, procedures, and the historical evolution of current regulations
Specific Content:	FA Act of 1958; ACRP functions (certification, continued airworthiness, regulatory and policy development); applicable FAR's/CAR's/CAN's and their origins; applicable TSO's, AC's and policies; AA orders, action notices and handbooks; interrelationships of the preceding policies and procedures; Regulatory Flexibility Act; Noise Control Act; Environmental Protection Act
Levels of Application	Illustrations of Proficiency
Basic - ACO Engineer	<p>Evaluates proposed certification application.</p> <p>Reviews DER submittals (or audits DER's approvals) and prepares recommendations for annual renewal.</p> <p>Reviews PMA and TSO submittals for compliance with regulations and prepares approval letters.</p> <p>Explains design approval process to applicant for area of specialization, but seeks assistance on interdisciplinary requirements (e.g., production approvals).</p> <p>Reviews service difficulty information, assesses accurately the technical and safety issues involved, and initiates corrective action.</p>
Training	
	<p>Certification engineering indoctrination course (FAA)</p> <p>Reliability, probability, safety analysis course (FAA)</p> <p>OJT: Review type certification handbook (FAA Order 8110.4)</p>

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Advanced - ACO Engineer	<p>Applies range of criteria (e.g., safety, political, operational, economic, technical) and makes accurate assessment of a service difficulty to arrive at a conclusion that is consistent with directorate policy/guidelines.</p> <p>Evaluates the adequacy of existing regulations to certify novel and unique design features (e.g., aircraft configuration, new drive system concept, use of composite materials) and determines acceptable methods to find compliance (i.e., special condition, equivalent safety finding).</p> <p>Evaluates test proposal for new methods of accomplishing a compliance test (e.g., Iron Bird vs. aircraft).</p> <p>Evaluates applicant's test proposals for determining the suitability of proposed new materials and applications (e.g., adhesives, various composites).</p> <p>Determines the appropriate level of review of technical reports depending on DER involvement.</p> <p>Reviews applicant's certification plan and provides feedback on its compliance/non-compliance with regulations and policies.</p> <p>Participates in the development of an AC, at the request of the directorate.</p> <p>Evaluates the appropriateness and adequacy of limitations for incorporation in the Limitations section of the instructions for continued airworthiness (i.e., limitations apply to all engineering disciplines).</p> <p>Explains procedures and guides applicant through the stages of type certification program. (Project Management)</p> <p>Develops and recognizes aircraft design features which require development of special conditions. (Project Management)</p> <p>Establishes the applicable regulation and advisory material to apply to the certification program. (Project Management)</p> <p>Discusses significant aspects of certification program with applicant (e.g., clarifies intent of regulatory requirements, identifies special attention items). (Project Management)</p>	<p>DAR, DAS, DMIR, DOA training course (FAA)</p> <p>Orientation on FAR Part 21 for project managers</p>

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

FAA-Industry Knowledge:	Government and Industry Standards	Definition: Knowledge of government and industry standards related to acceptable aircraft design and installation standards	Specific Content: Manufacturer specifications, industry standards (ASTM, SAE, RTCA), AN (Army-Navy) specifications, military specifications, other government standards and specifications, advisory circulars, policy information
<hr/>			
Levels of Application	Illustrations of Proficiency	Training	
Basic - ACO Engineer	<p>Reviews applicant's submitted material to ensure that referenced government and industry standards are complied with (i.e., material presented is within the limitations of the standard).</p> <p>Ensures that the use of a particular specification is appropriate for the type of data submitted (e.g., flammability requirements).</p>	Certification engineering indoctrination course (FAA)	OJT: Review existing government and industry standards for engineering specialty

Advanced - ACO Engineer

- Employ existing policy guidance and standards to determine the acceptability of a manufacturer's proposed standard.
- Participates in the review, revision/drafting of new industry/government standards, as required.
- Reviews and determines that the design complies with the appropriate level of verification required by the applicable government/industry standard
- Explains use and application of advisory circulars to certification program. (Project Management)
- Advises applicant on use of government and industry standards related to certification program. (Project Management)

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

FAA-Industry Knowledge:	Drawing Systems and Standards	Definition: Knowledge of the organization of drawing systems and or accepted aircraft drawing standards that define type design	Specific Content: Drawing lists, top assembly drawings, detail drawings, engineering changes to drawings, specification/source control drawings, repair drawings, procurement specifications, finish specifications, manufacturing specifications, assembly specifications, process specifications, change control procedures, service bulletins
<hr/>			
Levels of Application	Illustrations of Proficiency	Training	
Basic - ACO Engineer	<ul style="list-style-type: none">Instructs applicant with minor change/modification on the general requirements for preparing and submitting drawings and specifications for design approval.Reviews applicant's minor design drawing (sub-assembly or part detail) for completeness (i.e., contains all elements specified in FAR).Ensures appropriate specifications are referenced on a drawing (e.g., environmental test requirements, material specifications, etc.).Reviews applicant's drawings to ensure proposed aircraft or engine revisions are adequately and correctly described (e.g., dimensions, specifications, part numbers, sources).	<p>OUT: Work with experienced engineer and manufacturing inspector on reviewing manufacturer's drawing systems; review industry standard on organization of drawing system</p>	

Advanced - ACO Engineer

- Researches service difficulties, changes in type design, PMA's, etc. using a specific applicant's drawing system.
- Reviews applicant's major design drawing (complete assembly or complete installation drawing) for accuracy and comprehensiveness (i.e., contains all elements specified in FAR).
- Reviews complex drawing systems to identify deficiencies in design and specifications.

OUT: Work with DER to acquire in-depth understanding of major applicant's drawing system

Levels of Application

Illustrations of Proficiency

Training

Advanced - ACO Engineer
(Continued)

Reviews new applicant's drawing system and standards to ensure proper organization of drawings and adequacy of procedures to control changes.

Establishes the master drawing list for describing the type design product.
(Project Management)

Verifies with applicant an acceptable drawing system and standards for a certification program to include audit procedures and change/revision procedures. (Project Management)

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

FAA-Industry Knowledge:	Aircraft Operations and Maintenance Procedures	Definition: Knowledge related to maintaining and operating aircraft for continued safe and efficient operations	Specific Content: Maintenance and operating requirements (manuals) for each aircraft, standard maintenance and operating procedures, inspections, life-limits, MMEL, maintenance review board (MRB), structural repair manual, wiring diagram manual
Levels of Application	Illustrations of Proficiency	Training	
Basic - ACO Engineer	Reviews and approves instructions for continued airworthiness in the FAA-approved portion of the aircraft maintenance manual.	OUT: Visits to operators to observe NDT Airplane operations for engineers course (FAA)	
	Ensures AFM or AFM supplement incorporates operational procedures and limitations for installed equipment on aircraft.	Airworthiness surveillance course (FAA) Maintenance steering group (MSG-3) course (FAA)	
		Aircraft familiarization course (industry)	
Advanced - ACO Engineer	Reviews and approves information/data for engineering specialty that is contained in the aircraft flight manual/supplement. Participates in maintenance review board, as required, as representative of technical specialty to provide information on service intervals, critical components, etc.	Orientation visits to airlines to observe maintenance procedures Aircraft maintenance reliability program course	
	Develops inspection/maintenance requirements that are compatible with aircraft operations and maintenance procedure.	OUT: Participate in DAS, SFAR-36 audits	

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

FAA - Industry Knowledge:	Foreign Airworthiness Regulations and Bilateral Agreements
Definition:	Knowledge related to foreign airworthiness standards (regulations and published advisory material) and to current bilateral agreements and their overall impact on type certification programs
Specific Content:	Applicable Joint Airworthiness Requirements (JAR) documents for European projects; applicable national standards for specific countries (e.g., ECAR's for Great Britain); published policy material, if available, from appropriate country; applicable bilateral agreements; AC 21-29-3B; applicable FAA orders and handbooks that relate to foreign regulations and bilateral agreements

Levels of Application

Illustrations of Proficiency

Training

Basic - ACO Engineer	Compares foreign airworthiness standards with FAR's and documents differences in requirements.	Import certification procedures training course (FAA)
	Requests conformity inspection on foreign manufactured parts and appliances that are part of a U.S. manufacturer's type design.	OJT: Accomplish certification work on small aspects of foreign certification projects
	Issues TSO approval letters to foreign manufacturers.	
Advanced - ACO Engineer	Establishes/participates in establishing the U.S. certification basis by defining special conditions and/or requirements that account for differences between FCAA requirements and FAR's.	Orientation program for project managers on foreign certification requirements
	Becomes familiar with the proposed design and advises FCAA and manufacturer's representatives of compliance needs for unusual features, traditionally different design philosophies, and issue paper subjects.	Rotational assignments with directorate foreign certification branch
	Compares differences between FAA and FCAA guidance material (i.e., AC's) and develops issue papers on any differences between the acceptable means of compliance.	
	Participates in foreign airworthiness assistance program/training programs to evaluate FCAA's ability to qualify for a bilateral agreement.	

Levels of Application

Advanced - ACO Engineer
(Continued)

Advises applicant on requirements for TC on foreign manufactured aircraft and serves as prime contact with foreign authorities for program administration and any additional requirements for U.S. certification.
(Project Management)

Assists FCAA in obtaining compliance determination. (Project Management)

Illustrations of Proficiency

Training

TC

Advises applicant on requirements for TC on foreign manufactured aircraft and serves as prime contact with foreign authorities for program administration and any additional requirements for U.S. certification.
(Project Management)

Assists FCAA in obtaining compliance determination. (Project Management)

ACO MECHANICAL - ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

FAA-Industry Knowledge:	FAA Functional Relationships with Aircraft Manufacturers, FCAA's, Aviation Associations, and Professional Societies									
Definition: Knowledge of FAA relations with aircraft manufacturers and foreign civil airworthiness authorities relating to type design, type certification, and continued airworthiness; and knowledge of FAA relations with aviation associations and professional societies including their function in aviation safety	<p>FAA dealings with manufacturers on administering type certification programs, resolving service difficulties, and monitoring new developments and technologies; civil aviation industry, aviation associations, and professional societies affected by material developed by the FAA so that proper coordination can be accomplished with them; technical organizations developing papers, reports, etc. in areas related to FAA's responsibilities; key industry organizations and key personnel in these organizations; industry groups that promote aircraft airworthiness and their contact points; foreign cultural, foreign civil airworthiness authorities, and industry relationships; industry sources willing to support FAA activities; contacts for initiating industry participation; knowledge of legal aspects of eliciting support from above groups; determination of government or industry responsibility for conducting studies or research</p>									
Specific Content:	<p>Illustrations of Proficiency</p> <p>Training</p> <table border="1"><thead><tr><th>Levels of Application</th><th>Illustrations of Proficiency</th><th>Training</th></tr></thead><tbody><tr><td>Basic - ACO Engineer</td><td>Fosters day-to-day contact with manufacturers in type certification projects to maintain continuity and remain aware of program status. Participates in DER surveillance activities and presents information/interpretative material at DER conferences. Maintains active membership in applicable professional societies (AHS, HAI, ISASI) to promote exchange of technical information. Makes prepared presentations at various instructional programs (i.e., Rotorcraft Accident Investigation course).</td><td>Certification engineering indoctrination course (FAA) Maintenance familiarization course (Manufacturer) Orientation visit to manufacturer's facility to discuss organization, management staff, responsibilities</td></tr><tr><td>Advanced - ACO Engineer</td><td>Participates in meetings and coordinates with foreign civil airworthiness authorities on certification projects (e.g., FCAA's, Brussels office). Participates in professional society activities to maintain expertise: serve on technical committees, present technical papers.</td><td></td></tr></tbody></table>	Levels of Application	Illustrations of Proficiency	Training	Basic - ACO Engineer	Fosters day-to-day contact with manufacturers in type certification projects to maintain continuity and remain aware of program status. Participates in DER surveillance activities and presents information/interpretative material at DER conferences. Maintains active membership in applicable professional societies (AHS, HAI, ISASI) to promote exchange of technical information. Makes prepared presentations at various instructional programs (i.e., Rotorcraft Accident Investigation course).	Certification engineering indoctrination course (FAA) Maintenance familiarization course (Manufacturer) Orientation visit to manufacturer's facility to discuss organization, management staff, responsibilities	Advanced - ACO Engineer	Participates in meetings and coordinates with foreign civil airworthiness authorities on certification projects (e.g., FCAA's, Brussels office). Participates in professional society activities to maintain expertise: serve on technical committees, present technical papers.	
Levels of Application	Illustrations of Proficiency	Training								
Basic - ACO Engineer	Fosters day-to-day contact with manufacturers in type certification projects to maintain continuity and remain aware of program status. Participates in DER surveillance activities and presents information/interpretative material at DER conferences. Maintains active membership in applicable professional societies (AHS, HAI, ISASI) to promote exchange of technical information. Makes prepared presentations at various instructional programs (i.e., Rotorcraft Accident Investigation course).	Certification engineering indoctrination course (FAA) Maintenance familiarization course (Manufacturer) Orientation visit to manufacturer's facility to discuss organization, management staff, responsibilities								
Advanced - ACO Engineer	Participates in meetings and coordinates with foreign civil airworthiness authorities on certification projects (e.g., FCAA's, Brussels office). Participates in professional society activities to maintain expertise: serve on technical committees, present technical papers.									

Levels of Application

Advanced - ACO Engineer
(Continued)

Illustrations of Proficiency

Training

Participates in joint airworthiness conferences with foreign civil airworthiness authorities to resolve issues relative to joint certification regulation.

Interfaces with a manufacturer to determine its proposed corrective action on a service difficulty problem with its products; drafts and coordinates resulting AD with manufacturer and appropriate aviation association (e.g., ATA).

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

FAA- Industry Knowledge:	Manufacturer's Publications	
Definition:	Knowledge of manufacturing publications: contents, process for revision, and relevancy to certification/airworthiness policy	
Specific Content:	Service publications, parts catalogs, maintenance manuals, service bulletins, flight manuals, operational bulletins, pilot's operating handbooks, wiring diagram manuals, service information notices of various types	
Levels of Application	Illustrations of Proficiency	Training
Basic - ACO Engineer	Reviews and approves various publications (e.g., service bulletins that cover a minor change) with no consideration for the interrelationship between different types of publications.	OJT: Work with experienced engineer to gain familiarity with manufacturers' terminology and publications
	Identifies manufacturing publications that require FAA approval by determining that the information submitted constitutes a change to type design.	FAA seminar on various publications used by a manufacturer
	Reviews DER-approved service bulletins to ensure all appropriate disciplines have concurred.	
Advanced - ACO Engineer	Reviews service bulletins from manufacturers for possible AD action.	
	Reviews manufacturers' service bulletins to ensure they are properly and satisfactorily prepared for eventual use in AD's.	
	Reviews and comments on the technical content of manufacturers' publications relative to their compliance or non-compliance with applicable regulations based on established guidelines.	
	Determines the correct use of all manufacturers' publications as substantiating data (i.e., not using parts catalog for PMA approvals).	
	Reviews proposed changes/supplements to AFM to ensure prerequisite documentation is complete, has been substantiated, and complies with applicable FAR prior to approval.	

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

FAA-Industry Knowledge:	FAA Organization Structures, Functions, Relationships, Practices, and Resources Available for Technical Support and Training	Training
Definition:	Knowledge of FAA organizational elements, and their relationship to each other and to applicants; of FAA operating policies and approved administrative and personnel procedures; of resources providing guidance, background information, national policy, and technical data	
Specific Content:	Flight standards, ATC, airway facilities, regional counsel, certification (directorate system, Washington function, and foreign offices), DER/DAS/DOA operation, FAA interface with manufacturers, civil service structure, OPM/OMB; resources such as FAA Academy, MTS, NASA, Department of Defense, technical center, CAMI, NRS, schools, industries, research labs, technical organizations and their technical publications	
Levels of Application	Illustrations of Proficiency	Training
Basic - ACO Engineer	Determines proper coordination requirements (e.g., AEG, regional counsel, directorate) for various FAA documents - AD notes, operational limitations, certification documents.	Directorate/ACO indoctrination program on organization, working relationships, branch functions
	Explains organization and responsibilities of units within the FAA to new applicants.	Certification engineering indoctrination course (FAA)
	Identifies the specialties involved in a certification project and disseminates data for their review and approval.	
	Determines the need for and appropriate level of technical support required for a certification program (e.g., significant, non-significant program).	
Advanced - ACO Engineer	Solicits assistance and information from FAA organizational resources (e.g., directorate, HQ, technical center) relative to the solution of major certification problems.	Orientation program for project managers on appeal procedures, FCAA's, bi-lateral agreements
	Coordinates with applicable engineering disciplines, project manager, and other organizations (e.g., flight standards, AEG) to ensure timely completion of significant projects.	

Levels of Application

Illustrations of Proficiency

Training

Advanced - ACO Engineer
(Continued)

Participates as functioning member of various audit and inspection teams (e.g., QASAR, DAS, and SFAR-36 audits; NASIP team).

Advises applicant on specific organizational roles in certification program - procedures for appealing a certification decision to directorate and FAA Headquarters; procedures for obtaining exemptions from directorate. (Project Management)

Advises applicant of available technical resources for completing a certification program. (Project Management)

Decides on organizational representation at type certification board meeting (i.e., members within and outside ACP). (Project Management)

Explains role of accountable directorate in providing standardization interpretation of regulatory requirements to applicant. (Project Management)

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Skill/Ability:

Skill in Applying the FAR

Definition: Application of regulatory requirements to designs, test reports, analyses, specifications, and other data in order to determine compliance

Specific Content: Distinguish unique and novel design features or operating technologies, particularly if they are not covered by the FAR's or are not found on aircraft in service; identify existing rule, need for special condition, exemption; equivalent safety finding; evaluate safety requirements against available data and determine criteria for compliance approval; determine if technology necessitates a rule change; develop issue papers, advisory circulars, or new policies

Levels of Application

Training

Illustrations of Proficiency

Basic - ACO Engineer Reviews and compares applicant's analyses, test plans and proposals to determine that the procedures and data used are as required by FAR's (i.e., appropriate safety factors are used, specific ground endurance run is properly defined as required by FAR).

Identifies the existing rule/rules that apply to the particular document or analyses submitted by an applicant.

Determines need for design coordination with other engineering disciplines on FAR requirements (e.g., systems and powerplant requirements for generator installation, engine-airframe interface on engine mounts, nacelles, etc.).

Reviews simple design and is able to find compliance with existing regulations (e.g., video entertainment system).

Advanced - ACO Engineer

Determines if existing rules are adequate to properly assess data design/concept being submitted.

Identifies unique or novel design features not adequately addressed by existing regulations (e.g., EFIS, composites).

Certification engineering indoctrination course (FAA)

Reliability, probability, safety analysis course (FAA)

OJT: Assume projects of increasing diversity and complexity

Orientation on FAR Part 21 for project managers

Levels of Application

Illustrations of Proficiency

Training

Advanced - ACO Engineer
(Continued)

Determines acceptable method for finding compliance with new, novel and unique design features (i.e., special condition, exemption, equivalent level of safety finding, issue paper).

Proposes changes to existing rules that do not adequately address new technologies (e.g., fly-by-wire, damage tolerance, lightning protection, relaxed stability).

Applies applicable sections of FAR Part 21 to certification program (e.g., new or novel design features, special conditions, equivalent safety findings). (Project Management)

Applies new policies/procedures developed by accountable directorate and FAA Headquarters. (Project Management)

Skill/Ability:

Communication Skills

Definition:

Skills related to general writing, speaking and presentations, and to regulatory technical writing

Specific Content:

Write and speak clearly using accepted grammar and syntax; express ideas accurately, succinctly, and persuasively both orally in and writing; be at ease in a group situation; be able to lead a discussion without dominating it; write and edit drafts in accordance with office procedures or guidelines; be aware of office policies regarding drafts, revisions, and final versions of letters and documents; anticipate management questions or concerns regarding technical issues in letters or documents, develop and organize information to present complex material clearly to less knowledgeable people

Levels of Application

Illustrations of Proficiency

		<u>Training</u>
Basic - ACO Engineer	Discusses either orally or in writing type certification issues of a relatively non-complex nature.	Communication skills - improving organizational effectiveness (FAA)
	Drafts simple regulatory documents in accordance with established procedure (e.g., airworthiness directive, TC data sheets).	Effective writing (FAA)
	Presents proposed airworthiness directive to ADRB concisely and comprehensively by discussing background, precise need for AD, compliance time, particulars on requirements, type of corrective action.	Report writing (FAA)
		Writing improvement (FAA)
		Toastmasters organization
		Technical writing (FAA)
Advanced - ACO Engineer	Presents and discusses complex technical certification issues in a clear, precise manner to a variety of audiences.	Briefings and presentations course
	Drafts complex regulatory documents in accordance with established procedures (e.g., issue papers, requests for exemption, AD's).	Professional seminars on advanced writing and speaking
	Develops and presents technical briefings on FAA interpretations of regulations and specific methods of compliance (e.g., to professional society seminars, to DER conferences, industry-association conferences).	AVS rulemaking course (FAA)

Levels of Application

Illustrations of Proficiency

Training

Advanced - ACO Engineer
(Continued)

Prepares and presents technical training course to selected organizations (e.g., FCAA's) -- writes course material, prepares briefing slides and handouts, etc.

Drafts written response to Congressional inquiry that addresses the issue, and clearly and tactfully explains the FAA position.

Testifies at NTSB hearings or other legal proceedings as subject-matter expert clearly, and authoritatively articulates FAA position.

Establishes and maintains open communication with all levels of FAA employees, applicant, and public to ensure timely, accurate review of certification issues. (Project Management)

Serves as spokesman for project activities or for public presentation on certification program. (Project Management)

Facilitates discussion of complex technical issues during TC board meeting and prepares accurate minutes of board meetings, briefing papers, and related correspondence. (Project Management)

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Skill/Ability:	Human Relations Skills	Definition:	Skills in establishing and maintaining positive interpersonal relations, both within and outside the FAA	Specific Content:	Listen objectively, give feedback in a positive way, conflict resolution, be sensitive to the feelings and perceptions of others; maintain cordial and professional attitudes when dealing with difficult or emotional people; respect cultural differences
Levels of Application	Illustrations of Proficiency	Training			
Basic - ACO Engineer	Avoids taking dogmatic, inflexible positions in dealings with applicant to resolve specialty area issues. Promotes effective work relations by anticipating problem areas and preparing solutions for consideration during subsequent discussions or meetings.	Interpersonal solving course (FAA) Work group facilitator course (FAA)			Leadership effectiveness training course (FAA)
Advanced - ACO Engineer	Solicits advice from others to obtain alternate approaches and their aid in problem resolution. Accepts responsibility for participation in office human relations committees activities.	OJT: Selected readings on human relations	Conflict resolution course (university)	Group dynamics course (university)	Negotiations course (university) Assertiveness training course (university)

Levels of Application

Illustrations of Proficiency

Training

Advanced - ACO Engineer
(Continued)

- | <u>Levels of Application</u> | <u>Illustrations of Proficiency</u> | <u>Training</u> |
|--|---|--|
| Advanced - ACO Engineer
(Continued) | <p>Resolves critical issues within project team through participatory management. (Project Management)</p> <p>Promotes understanding and assurance for applicant that timely, acceptable solutions to certification problems can be achieved. (Project Management)</p> <p>Solicits inputs from team members and is open-minded to their views in developing project goals and objectives. (Project Management)</p> <p>Motivates project team members by providing direction, planning, and scheduling. (Project Management)</p> | <p>Professional course</p> <p>Management team action (FAA)</p> |

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Skill/Ability:

Project Management and Team Leadership Skills

Definition:

Skill related to managing a project and/or directing the efforts of a team to reach a common goal

Specific Content:

Identify project goal; coordinate team membership; identify specific objectives; identify tasks; recognize individual differences in talent, knowledge, personalities; motivate team members to common goals and objectives; follow up on assigned tasks; schedule appropriate meetings and control group dynamics during team meetings; finalize action to realize goal(s); organize material needed by team; prepare and follow agenda for team meetings; when applicable, make specific team assignments with schedules for accomplishment; at completion of team function, develop report of team accomplishments, recommendations for management review

Levels of Application	Illustrations of Proficiency	Training
Basic - ACO Engineer	<p>Identifies ACRP disciplines involved in routine, non-complex project.</p> <p>Coordinates on work of other specialists involved in the project and with applicant's engineering staff.</p> <p>Monitors progress of project within specialty to ensure overall schedule of project is maintained.</p>	<p>Leadership effectiveness training course (FAA)</p> <p>Project information control system course (FAA)</p> <p>FAA seminar on program management</p>
Advanced - ACO Engineer	<p>Coordinate with ACRP disciplines necessary to achieve completion of assigned project, and conducts fact-finding meetings to determine specific tasks required to achieve project team goals.</p> <p>Prepares realistic schedule to accomplish assigned goals within defined guidelines.</p> <p>Schedules and conducts status meetings with applicant or other project team members to determine overall progress of project, and resolve problems/concerns.</p>	<p>Professional seminar on engineering management (university)</p> <p>Program management (university)</p> <p>Management team action (FAA)</p>

Levels of Application

Illustrations of Proficiency

Training

Advanced - ACO Engineer
(Continued)

Prepares summary status reports for specialty at scheduled milestones to measure project completion and inform management on status of program.

Coordinates on preparation of final report upon completion of project as an official record of compliance for TC project.

Organizes and manages project team, identifies project goal, and motivates team members toward satisfactory results. (Project Management)

Assigns specific tasks and objectives to project team members. (Project Management)

Maintains awareness of certification program status and, when appropriate, recommends alternative action on controversial issues to management. (Project Management)

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

skill/ability:

Personal Management of Time and Workload

Definition:

Skill required for optimizing use of personal time to complete workload items that result in the best product

Specific Content:

Identify tasks; highlight potential time-consuming tasks or controversial tasks; provide feedback to supervisor on time usage requirements; schedule available time to match tasks (including consideration of controversial tasks); minimize distractions, allow buffer time in schedule; be flexible when faced with the unexpected; identify the need for and seek help as necessary; identify and prioritize significant project issues

Levels of Application

Illustrations of Proficiency

Training

Basic - ACO Engineer	Maintains a schedule that reflects project priorities, needs and demands.	Time management training course
	Keeps supervisor apprised of workload and, when unexpected conflicts or delays with applicant become apparent, revises schedule accordingly.	
	Minimizes distractions or time wasters and organizes working materials and work area for efficient access and use.	
Advanced - ACO Engineer	Makes a realistic assessment of personal involvement in unscheduled, time consuming tasks (e.g., SCR team, audit, AD's) so that an accurate reflection of task impact on current workload can be made.	Manage your stress (FAA)
	Varies depth or extent of review of technical information to evaluate fully the significant and/or critical facets of a project.	
	Prioritizes issues for resolution and establishes/recommends methods for problem solution: minimize distractions, automate reports, set time limits, communicate with management. (Project Management)	

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Skill/Ability:	Office Automation and Basic Computer Skills
Definition:	Skill in utilizing computers, as applicable, in certification program and technical engineering work
Specific Content:	Software literacy: Limited programming ability for analysis; knowledge of employing software packages developed for word processing, data management, statistical analyses, etc.

<u>Levels of Application</u>	<u>Illustrations of Proficiency</u>	<u>Training</u>
Basic - ACO Engineer	<p>Employs operating systems (e.g., DOS) for basic system management.</p> <p>Uses available applications (developed from off-the-shelf software) to accomplish work tasks and manage activities (e.g., word processing skills to draft documents; project management/data base management applications to track and/or manage programs and review progress on compliance checklist).</p> <p>Accesses and uses ACRP ASAS subsystems: AFARS, AWIS, RULE GENESIS, etc.</p>	<p>Application and use training in PICs, ASAS</p> <p>OJT: Software training (CBI), applications and keyboarding</p>
Advanced - ACO Engineer	<p>Defines a need for applications (using off-the-shelf software) to assist personnel in accomplishing work activities (e.g., project management, review compliance checklists, SDR analysis, etc.).</p> <p>Assists in the development of national systems for office automation (e.g., Beta test, preparation of system requirements).</p> <p>Develops and automates reports, briefing papers, and other documents within computer capability of the organization (e.g., word processing, information management). (Project Management)</p>	<p>Computer-based decision making (FAA)</p> <p>Computer use in project management (OPM)</p>

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: ILLUSTRATIONS OF PROFICIENCY AND TRAINING FOR KSA'S

Skill/Ability:	Analytical Ability in Problem Solving	Training
Definition:	Skill in objective analysis and problem solving, and the ability to develop, analyze, and interpret information that supports rational conclusions	
Specific Content:	Evaluate subject for the purpose of problem definition; research data or background of defined subject; establish or set priorities for any additional research or study required; discern multiple methods for solving a problem and recognize that various data are correct, appropriate, and meet defined criteria; evaluate, compare, and rank approaches to define subject; define solution or alternatives for problem; present results for critique by knowledgeable audience; refine solution based on critique	
Levels of Application	Illustrations of Proficiency	
Basic - ACO Engineer	<ul style="list-style-type: none">Identifies solutions for less complex problems using previously approved data and documents analysis in briefing papers or letters to applicants.Identifies the type and scope of data needed to solve a problem and then correlates it with known information.Focuses on design philosophy and assumptions, and is capable of reviewing and evaluating traditional analysis methods without assistance.	<ul style="list-style-type: none">Reliability, probability, safety analysis course (FAA)Engineering oriented course in statisticsSpecialty course for engineering discipline
Advanced - ACO Engineer	<ul style="list-style-type: none">Researches and organizes data to solve complex problems, and arrives at solutions (e.g., decision document that justifies an alternate means of compliance).Focuses on design philosophy and assumptions and reviews and evaluates advanced analysis methods.Identifies the need for additional technical research/assistance in understanding and applying advanced methods of analysis in order to make certification findings (e.g., assistance of NRS in software partitioning and damage tolerance).	<ul style="list-style-type: none">Approaches to staff studies (government)Advanced probability analysis models

Levels of Application

Illustrations of Proficiency

Training

- Advanced - ACO Engineer
(Continued)
- Analyzes specific technical problem in certification program in order to determine involvement of appropriate technical specialists. (Project Management)
 - Analyzes effectiveness of certification program in order to recommend additional policy guidance be developed or to recommend regulatory changes at completion of project. (Project Management)
 - Cultivates proactive approach to problem solving to develop corrective action and provide options to management. (Project Management)

SECTION 4 - PRACTICAL APPLICATIONS OF TASK AND KSA INFORMATION

Introduction A job task analysis (JTA) is not an end in itself; it is the first step in compiling a comprehensive data base that enhances the effectiveness of the ACRP in promoting aircraft safety. The strategic plan for the Aircraft Certification Service (see Project SMART, A Plan for Performance, FY 89) cites a number of objectives utilizing the JTA data. Among these are the development of a National Training Program, training curriculum development, recruitment and selection criteria for technical positions, model position descriptions, and staffing standards. The information provided in the Task and KSA books, together with the 10 volumes of Descriptive Work Procedures, will support the ACRP in accomplishing its strategic planning objectives. Table 4-1 describes the human resource management functions and tasks supported by the data.

TABLE 4-1

HUMAN RESOURCE MANAGEMENT FUNCTIONS AND TASKS SUPPORTED BY THE JTA DATA

FUNCTIONS	TASKS
Job Design	Writing Job Descriptions
Recruitment and Selection	Writing Job Announcements Preparing Crediting Plans Preparing Rating Schedules
Performance Appraisal	Writing Appraisal Plans Completing Appraisals
Training and Development	Constructing Job Profiles Assessing Employee Needs Developing Training Plans Designing and Developing Training Programs
Career Development	Defining Target Position Requirements Writing Development Plans

Continued . . .

SECTION 4 - PRACTICAL APPLICATIONS OF TASK AND KSA INFORMATION

Introduction (Continued)

The remainder of this section presents two detailed illustrations of how the data can be used to support ACRP strategic objectives. The first involves the development of a National Training Program; the second describes how the information can be used to enhance writing individual development plans.

SECTION 4 - PRACTICAL APPLICATIONS OF TASK AND KSA INFORMATION

APPLICATION ILLUSTRATION #1: NATIONAL TRAINING PROGRAM

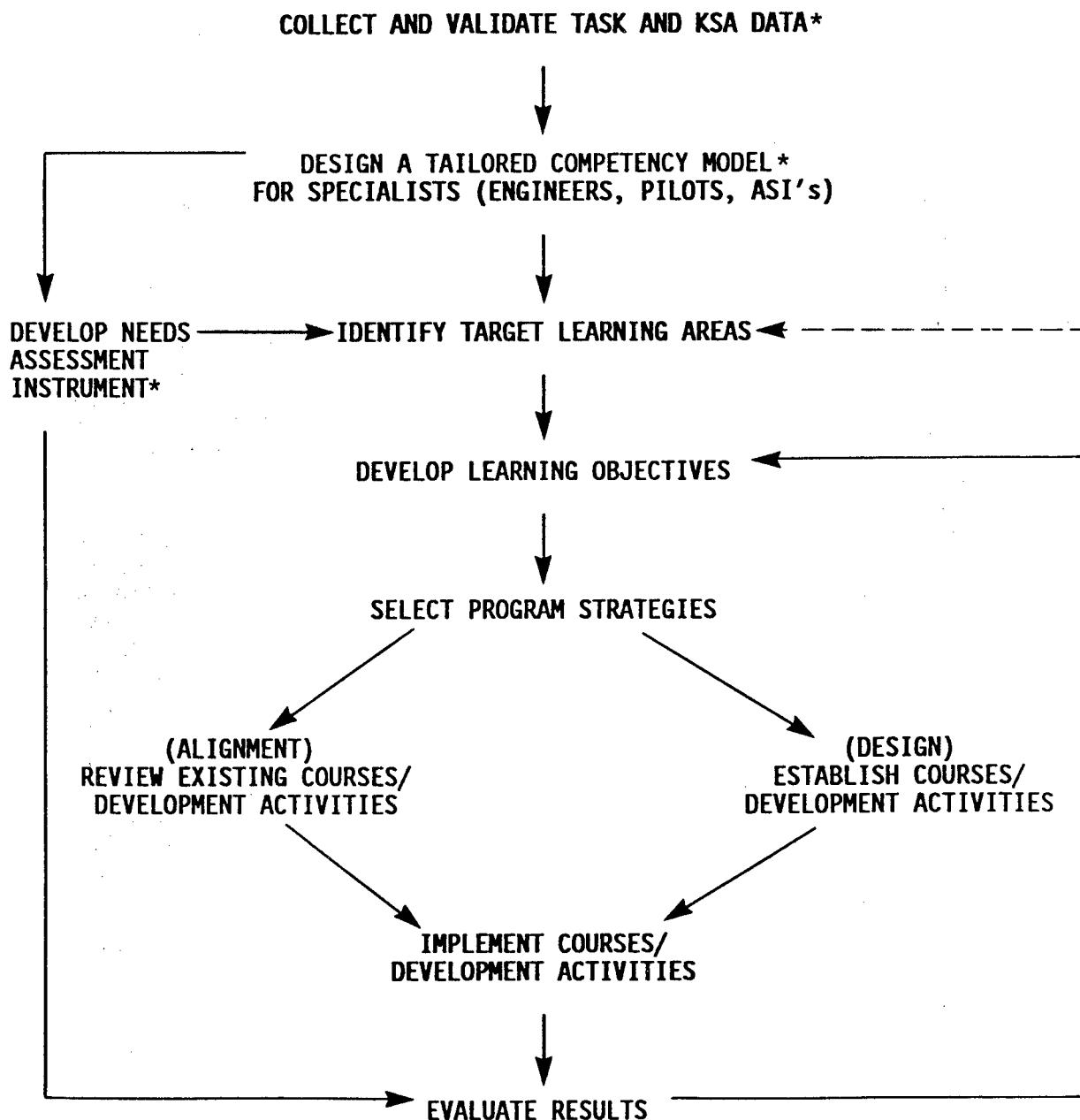
One of the major applications of the task and KSA information is in helping to establish a National Training Program for ACRP personnel. The Project SMART strategic planning document, A Plan for Performance (FY 89), calls for a national training plan as well as other objectives involving training. Specialists throughout the ACRP view training as critical for acquiring proficiency and expertise in their professions. And for specialists to maintain and enhance their value to the FAA they must continue their training to keep pace with their counterparts in industry. As stated in the Management Efficiency Study for the ACRP (September, 1987), "ACRP employees must have access to the latest technology hardware and software . . . so they can retain their technical skills in a constantly changing environment." The study goes on to address the need for a professional training system as a "powerful way to build recruitment and retention of talented employees." The information here together with the Descriptive Work Procedures directly support identification of training requirements and creation of training programs at the national or regional level, in an ACO, or at a MIDO.

In short, the task and KSA information provides the cornerstone for the creation of a competency-based training and development program. Figure 4-1 provides a framework for using task and KSA data for developing the training program. As the framework suggests, the task and KSA information yields a competency-based model tailored to the performance requirements of the particular group of specialists. Those tasks and KSA's that are most important to the organization become the target learning areas for the development program. The target learning areas are the basis for developing learning objectives. From these learning objectives, a strategy for the development program can be set, i.e., to align or design courses/activities to reflect these objectives. Once the program is implemented, results are evaluated. The evaluation may show the need to change the learning objectives which would then have an effect on the other components of the development program.

It should be noted that the JTA information compiled so far has resulted in the total or partial completion of three stages in the development of a national training program (see Figure 4-1).

SECTION 4 - PRACTICAL APPLICATIONS OF TASK AND KSA INFORMATION

FIGURE 4-1
FRAMEWORK FOR DEVELOPING A NATIONAL TRAINING PROGRAM



* Activities totally or partially completed as a result of JTA data collection.

SECTION 4 - PRACTICAL APPLICATIONS OF TASK AND KSA INFORMATION

APPLICATION ILLUSTRATION #2: INDIVIDUAL DEVELOPMENT PLAN

A National Training Program will not be effectively implemented without a coherent system for ensuring that individual training requirements are identified and supported. Valid training requirements for a specialist can then be meaningfully judged within the context of organizational needs. The method used within the ACRP to accomplish this objective is the individual development plan (IDP). The IDP provides a programmatic framework which aids the employee in his or her development efforts. The employee's primary goal is to maintain his or her technical "edge" by enhancing existing knowledges or skills or cultivating new ones. Technical development also provides an incentive for the employee to stay in the organization. An IDP prepared jointly by an employee and supervisor helps the employee to identify areas in which further development is needed or desired, to set short-term and long-term goals, and to plan educational courses and developmental training that meet personal needs. These plans are made against the backdrop of organizational needs; as a result, the IDP is a useful tool for integrating personal training needs with organizational goals.

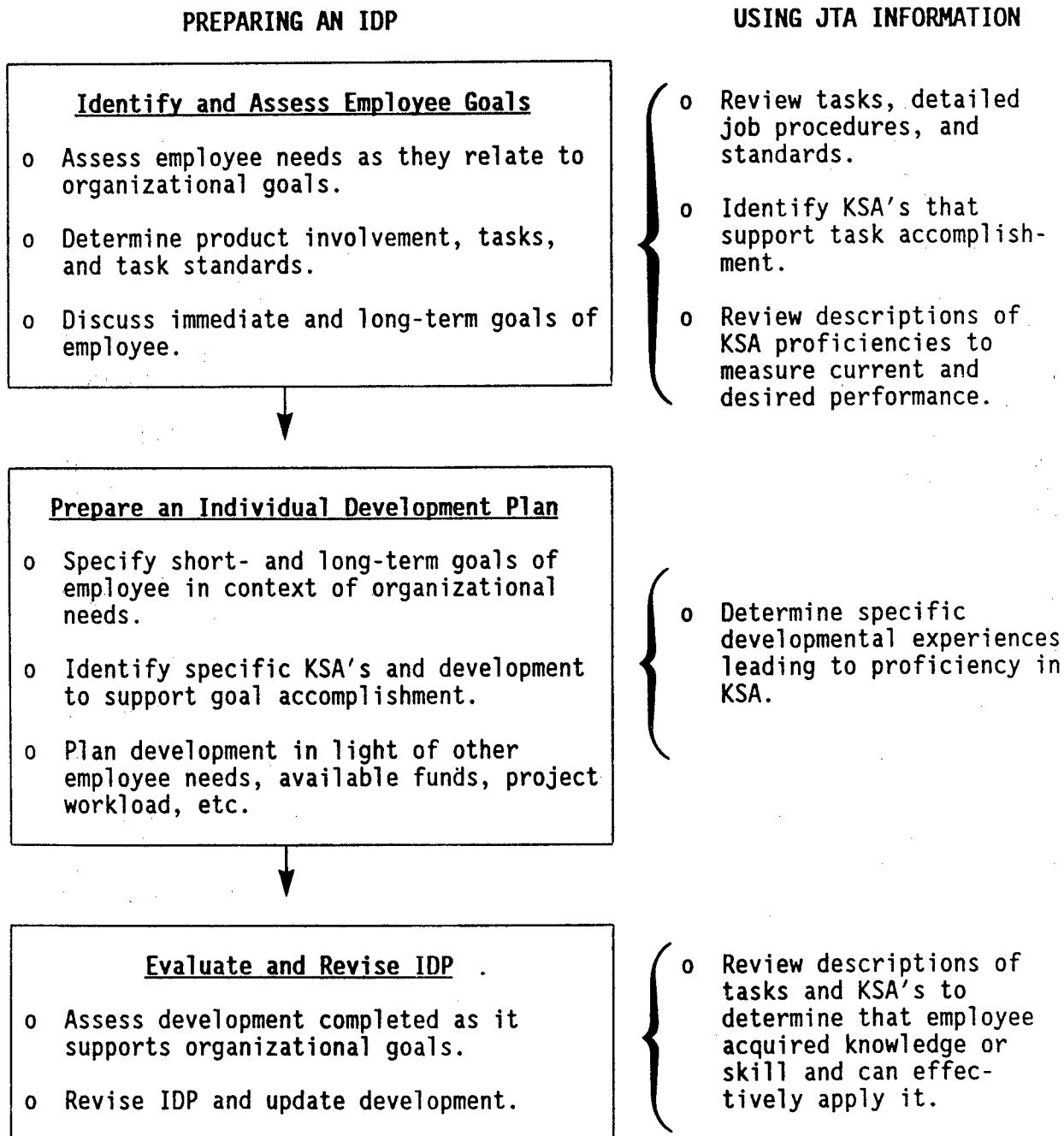
The JTA data can assist both employees and supervisors in developing an IDP by providing a framework for identifying the project demands imposed on the organization, the knowledges and skills required to successfully perform the work, and the training options available to employees.

Figure 4-2 illustrates the uses of JTA information in the IDP process by showing the steps involved in preparing the IDP, the role of the supervisor and employee in each step, and the uses of the JTA information.

Figure 4-3 presents a sample IDP completed for a mechanical-environmental systems engineer. All the information regarding the technical knowledges and skills required and the developmental assignments and formal training courses that facilitate acquisition of those knowledges or skills are contained in this book.

SECTION 4 - PRACTICAL APPLICATIONS OF TASK AND KSA INFORMATION

FIGURE 4-2
USE OF JTA INFORMATION IN IDP PROCESS



SECTION 4 - PRACTICAL APPLICATIONS OF TASK AND KSA INFORMATION

FIGURE 4-3 SAMPLE INDIVIDUAL DEVELOPMENT PLAN

Employee Name 1 Andrew Ryan	Grade 2 GS-11	Position Title 3 Aerospace Engineer (Mechanical-Environmental)	Organizational Element 4 ASW-150	Name of Supervisor 5 Edward West
Section I. Career Goals				
Short Range Goals 6	Long-Range Goals 7			
<ul style="list-style-type: none"> - Attain promotion to GS-12 aerospace engineer. - Serve as project manager for minor STC program. - Serve as project engineer representing Airplane Certification Branch on project team for type certification project. 		<ul style="list-style-type: none"> - Attain promotion to GS-13. - Assignment as Regulations and Guidance Professional, Regulations Program Management, ASW-111 (within 5 years). 		
Section II. Individual Development Plan (To be completed by Supervisor and Employee)				
Develop Objectives (Knowledge, skills and abilities needed to reach goal) 8	Developmental Assignments (On-the-job training, details, etc.; include target date for completion) 9	Other Activities 10		
Airframe icing protection	OJT: Witness manufacturer's icing tests after reviewing test proposal.	Review service difficulty reports on wheels, tires, and brake systems.		
Wheels, tires, brake systems	OJT: Assist experienced engineer in reviewing de-icing equipment installation during normal/failure conditions.	Review NTSB accident reports involving wheels, tires, brake systems; severe icing conditions.		
Communications skill	OJT: Determine criteria for continued airworthiness of certification maintenance requirements of wheels, tires, and brake systems, under experienced engineer.			
Section III. Formal Training and Time Frame for Accomplishing Training				
Remarks 11	Formal Training (e.g., FAA, Interagency, Non-government courses. To be completed by supervisor and employee.) 12	Projected Cost 13	Record of Accomplishment Projected Completion Date 14	Actual Completion Date 15
Accident-incident investigation course (USC)		\$1,100.00	July 89	
Employee's Signature	Date	Second Level Supervisor's Signature		Date
Supervisor's Signature	Date			

NOTE: This Individual Development Plan (IDP) is subject to changes depending on availability of funds.

APPENDIX A

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY 25% OR FEWER SURVEY RESPONDENTS**

APPENDIX A

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY 25% OR FEWER SURVEY RESPONDENTS**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG</u>	<u>SUPVSR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG</u>	<u>SUPVSR</u>	<u>PRODUCT</u>
1.	Conducts and directs flight tests.	21.00	5.00**	-	4.00	1.00	5.00**	-	337 Field Approval
2.	Evaluates and approves flight test emergency provisions and procedures.	20.00	4.00**	4.00	4.00	4.00	4.00**	2.00	Type Certificate: Domestic
3.	Monitors service difficulty meetings (as a Flight Test Specialist) and reports and provides input regarding flight hazards associated with the service difficulties presented.	19.00	4.00**	4.00	4.00	3.00	3.00**	3.00	Prod In Svc Difficulty Eval
4.	Drafts the proposed Federal Aviation Regulation.	18.50	4.00**	3.33	4.00	2.50	3.00	2.33	Federal Aviation Regulation
5.	Compares the foreign certification basis with the U.S. certification basis to identify differences and advises foreign authority of additional technical conditions for U.S. certification.	16.00	3.67	4.00	3.67	2.33	2.67**	3.00	Type Certificate: Foreign
6.	Conducts crashworthiness evaluation of aircraft accident.	16.00	3.50	4.33	3.33	2.00	2.75	3.67	Accident/Incident Investigation
7.	Reviews the technical aspects of certification program.	15.50	3.75	3.50	3.50	2.25	2.50	2.25	Type Certificate: Foreign
8.	Participates in pre-flight test activities.	15.50	3.50	3.00	3.50	2.50	3.00**	2.00	337 Field Approval
9.	Prepares agenda items for and participates in type certification meetings.	15.25	3.50	3.80	3.50	2.25	2.25	2.80	Type Certificate: Foreign
10.	Delegates flight test tasks to be accomplished by DER's (pilot and engineer) during the certification program.	15.25	3.75**	-	3.25	3.00	2.75**	-	Type Certificate: Domestic
11.	Monitors and reviews the progress of the foreign authority toward certification.	14.75	3.50	3.33	3.50	2.25	2.00	2.33	Type Certificate: Foreign
12.	Reviews, coordinates, and recommends approval of/approves aircraft flight manual supplement.	14.50	3.50	3.00	3.00	2.50	4.50**	2.00	337 Field Approval

** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

SCALES	JOB CRITICALITY scores may range from a minimum of 2 to a maximum of 30. (Refer to page 2-5 for detailed explanation).
	IMPORTANCE (IMP), DIFFICULTY (DIFF), FREQUENCY (FREQ), and TRAINING NEED scores may range from a minimum of 1 to a maximum of 5. (Refer to page 2-5 for description of rating scales.)

APPENDIX A

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY 25% OR FEWER SURVEY RESPONDENTS (Continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>			<u>TRAINING NEED</u>			<u>PRODUCT</u>
		<u>ENG</u>	<u>SUPVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>ENG</u>	<u>SUPVR</u>	
13.	Reviews and recommends approval of production flight test procedures.	14.00	3.33**	3.00	3.33	2.67	2.33	Production Approval
14.	Provides assistance to FCAA's as requested in developing and implementing special arrangements.	14.00	4.00	3.50	3.00	1.33	1.67	2.00
15.	Conducts limited flight test evaluation of foreign aircraft.	13.50	3.50**	3.00	3.00	2.50	3.00**	2.00
16.	Coordinates and documents compliance with noise and emission requirements.	13.00	5.00**	-	2.00	3.00	1.00**	-
17.	Coordinates the preparation and revision of the TC, TC data sheet (TCDS), and STC.	13.00	3.75	3.00	2.75	2.75	1.50	1.83
18.	Drafts proposed new procedural guidance or revises existing guidance.	12.50	3.50	3.00	3.00	1.75	1.75	2.33
A-2	Participates in development of certification standards and advisory material with FCAA (i.e., develops common certification requirements).	12.25	3.25	3.50	3.00	2.00	2.00	2.25
	Reviews flight test data.	12.00	3.00	3.00	3.00	2.00	3.33**	2.00
	Drafts proposed advisory circular.	12.00	3.33	3.00	3.00	2.00	2.33	2.00
	Participates as team member in Aircraft Certification Program national evaluation.	12.00	3.50	3.25	3.00	1.50	1.50	2.00
	Coordinates the preparation/revision of the TC and TC data sheet.	11.75	3.50	3.00	2.75	2.00	1.75	2.67

A-2

** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

APPENDIX A

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY 25% OR FEWER SURVEY RESPONDENTS (continued)**

RANK	TASK	JOB CRITICALITY	IMPORTANCE ENG SUPERVR	DIFF	FREQ	TRAINING NEED ENG SUPERVR	PRODUCT
	24. Prepares, presents and/or reviews papers of a technical nature for professional societies or university symposia.	11.25	3.00** 2.33	2.00	2.25	2.50	2.00
	25. Prepares letter of foreign TSO design approval after receipt of FCAA certification statement and appropriate data.	11.00	3.00** 2.33	3.00	2.00	2.25	1.67
	26. Serves in an advisory capacity to Production Certification Board (PCB).	11.00	3.00** 3.00	3.00	2.00	1.50**	2.00
	27. Serves in an advisory capacity to Approved Production Inspection System (APIS) Board.	11.00	3.00** 3.00	3.00	2.00	2.00**	2.50
	28. Proposes new agency order or action notice or revision to existing order and notice. (See note)	11.00	3.00** 4.00	3.00	2.00	2.00**	2.00
	29. Participates in litigation action, when required.	10.75	2.75 3.14	3.25	1.50	3.00	3.00
A-3	30. Reviews and approves the installation of engine, engine-propeller combination, or propeller system in aircraft.	10.00	4.00** -	2.00	2.00	3.00**	-
	31. Reviews and approves certification structural design criteria report.	9.50	3.00** 4.00	2.50	2.00	2.00**	4.00
	32. Evaluates or proposes specific data reduction and expansion procedures.	9.50	2.50 2.50	3.00	1.50	2.50**	2.00
	33. Reviews applicant's flight test results.	9.00	2.00** 3.33	3.00	3.00	4.00**	2.00
	34. Conducts and directs flight tests in accordance with TIA.	8.33	2.67** 3.00	2.00	2.33	3.33**	3.00
	35. Reviews, coordinates, and recommends approval of aircraft flight manual.	8.00	2.00** 3.00	3.00	2.00	4.00**	1.67

Note: Task deleted on the recommendation of the task validation panels.

** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

APPENDIX A
**ADDITIONAL MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY 25% OR FEWER SURVEY RESPONDENTS (Continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG</u>	<u>IMPORTANCE SUPERVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEED ENG</u>	<u>TRAINING NEED SUPERVR</u>	<u>PRODUCT</u>
36.	Participates in pre-flight briefing.	8.00	2.00**	3.00	3.00	2.00	4.00**	2.50	Type Certificate: Foreign
37.	Reviews and coordinates revision to production flight test procedures.	8.00	3.00**	2.50	2.00	2.00	1.50	1.75	Surveillance of Prod Approval
38.	Prepares for individual test flight.	7.50	2.50	3.50	2.00	2.00	2.50	1.50	Type Certificate: Domestic
39.	Serves as member of Flight Operations Evaluation Board (FOEB).	7.00	3.00**	3.00	2.00	1.00	1.00**	2.00	Type Certificate: Domestic
40.	Maintains flight test team proficiency to assure safe and efficient conduct of assigned test programs.	7.00	2.00**	-	2.00	3.00	2.00**	-	Flight Test Training Programs
41.	Reviews and approves basic loads report.	-	-	-	-	-	-	-	Type Certificate: Domestic
42.	Reviews, coordinates, and recommends approval of Aircraft Flight Manual.	-	**	3.00	-	-	**	2.00	Type Certificate: Domestic
43.	Reviews and approves selected engine or engine-propeller installation and operating instructions as applicable (during an aircraft certification program).	-	-	-	-	-	-	-	Type Certificate: Domestic
44.	Requests and receives special training from the applicant (flight and ground) for flight test.	-	-	2.50	-	-	-	1.75	Type Certificate: Domestic
45.	Requests and receives special training from the applicant (flight and ground) for flight test.	-	-	-	-	-	-	-	Type Certificate: Foreign
46.	Participates in Flight Standardization Board (FSB) process, as requested.	-	-	-	-	-	-	-	Type Certificate: Domestic
47.	Assists as necessary in determining FCAA's ability to qualify for a bilateral agreement.	-	-	-	-	-	-	-	Bilat Airworthiness Agreement

** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

APPENDIX A**ACD MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS AND SUPERVISORS:
MEAN RATINGS FOR TASKS PERFORMED BY 25% OR FEWER SURVEY RESPONDENTS (Continued)**

<u>RANK</u>	<u>TASK</u>	<u>JOB CRITICALITY</u>	<u>IMPORTANCE ENG</u>	<u>IMPORTANCE SUPVR</u>	<u>DIFF</u>	<u>FREQ</u>	<u>TRAINING NEEDED ENG</u>	<u>TRAINING NEEDED SUPVR</u>	<u>PRODUCT</u>
48.	Serves as team leader in Aircraft Certification Program national evaluation. (See note)	-	- **	3.00	-	-	- **	3.00	Internal/National Evaluation

Note: Task deleted on the recommendation of the task validation panels.

** Statistical test to determine significant differences between engineers' and supervisors' ratings could not be computed.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS**

APPENDIX B

ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS: PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS

The following matrices represent a first attempt by panelists to associate the knowledges, skills, and abilities that are essential to successfully perform their most critical tasks. This preliminary linkage, while requiring further validation, provides an initial understanding of the task and KSA linkage. To identify the most critical tasks, tasks performed by more than 25% of the survey respondents were ranked on the basis of their job criticality scores. The highest-ranked tasks were then chosen as the most job critical tasks (see Section 2, Table 2-4).

The information is provided in two tables: one linking technical knowledges to the tasks, the other linking FAA-industry knowledges and skills/abilities to the same set of tasks. Table B-1 presents a linkage of job critical tasks to technical knowledges. Mechanical-environmental systems engineers provided linkage information during their panel session. Table B-2 presents a linkage of job critical tasks to FAA-industry knowledges and skills/abilities. Since this set of KSA's applies to all ACO engineers irrespective of specialty, this information was collected during panels of ACO engineers representing all engineering specialties, mechanical-environmental systems included.

Each knowledge or skill is listed across the top of each matrix. Job critical tasks are listed down the left side of each matrix. To allow a ready comparison of the KSA's essential for tasks performed for particular products (e.g., Design Approval-Domestic, Service Difficulty, etc.), the tasks are grouped and labeled by product.

In each cell, a symbol indicates the number of panelists who linked the task to the knowledge -- that is, those who indicated that the KSA is essential to successfully perform the task. Half or more of the panelists who did so is represented by an "X"; fewer than half is represented by an "O". If the KSA was not linked to the task at all, the cell is empty.

TABLE B-1
TECHNICAL KNOWLEDGES

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1

TECHNICAL KNOWLEDGES

TECHNICAL KNOWLEDGES	TASKS					
	Design Approval: Domestic	Design Approval: International	Design Approval: Both	Design Approval: None	Design Approval: Not Required	Design Approval: Not Applicable
Oxygen/protection systems	X	X	X	X	X	X
Hydraulic systems	X	X	X	X	X	X
Basic engineering principles	X	X	X	X	X	X
Pressure/vibration systems						
Wheels, tires, brake systems						
Air condition systems						
Fire protection systems						
Passeger safety/crashworthiness						
Rain removal systems						
Airframe lighting controls						
Powered flight controls						
Passenger icing protection systems						
Portable/waste handling systems						
Gauge/hanging systems						
Cargo handling waste systems for elc.						
Zone protection systems (large A/C)						
Equipment knowl. of functional components of A/C sys. (proj., mfrs.)*						
Interface, critical components of A/C sys. (proj., mfrs.)*						

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1
TECHNICAL KNOWLEDGES (Continued)

TECHNICAL KNOWLEDGES		TASKS
KEY	NUMBER OF PANELISTS = 6	
X	= Half or more of panelists linked KSA to task	Identifies the need for and develops issue papers during the certification program.
0	= Fewer than half of panelists linked KSA to task	Schedules and conducts project-specific meetings (specialist meetings) with the applicant.
Blank	= KSA not linked to task	Reviews applicant's certification plan for completeness and provides feedback.
BASIC ENGINEERING PRINCIPLES		
Hydrostatic systems		
Pressure/vibration principles		
Oxygen/protection systems		
Pneumatic systems		
Wheels, tires, brakes		
Air conditioning systems		
Passenger safety/crashworthiness		
Railroad safety controls		
Aircraft flight systems		
Powerplant heating		
Passenger protection systems		
Railroad safety controls		
Passenger safety controls		
Cooling/heating systems		
Portable/waste systems (large A/C)		
Zone protection systems (large A/C)		
Gen. knowl. of functional components of A/C sys. vs. interface, critical components (pro. sys.)*		
Gen. knowl. of high-energy rotors		

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1
TECHNICAL KNOWLEDGES (Continued)

TECHNICAL KNOWLEDGES		TASKS	NUMBER OF PANELISTS = 6					
KEY								
X	= Half or more of panelists linked KSA to task	Reviews and approves safety analyses (e.g., fault/failure analysis, FMEA) with respect to certification criteria.	0	X	X	X	X	X
0	= Fewer than half of panelists linked KSA to task	Reviews and approves test plans/procedures.	0	X	X	X	X	X
Blank	= KSA not linked to task	Reviews and approves drawings and material and process specifications for certification projects and makes findings of compliance.	X	X	X	X	X	X
NUMBER OF PANELISTS = 6								
Basic engineering principles								
Hydraulic systems								
Pneumatic systems								
Oxygen/Purification systems								
Hydraulic brakes								
Air condition systems								
Fire protection systems								
Powerplant flight control								
Aircraft safety/crashworthiness								
Rain removal/defogging systems								
Cooling/heating systems								
Portable/waste systems								
Cargo handling systems (large A/C)								
Zone handling systems (large A/C)								
Gen. knowl. of structural components of A/C sys.; sys. engrs.)*								
Interface, critical components of A/C sys.; sys. engrs.)*								

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1
TECHNICAL KNOWLEDGES (Continued)

TECHNICAL KNOWLEDGES	KEY	TASKS					
		Reviews and approves test results.	Reviews and approves analyses.	Evaluates and makes recommendations on a request for an equivalent level of safety finding.	Provides input items to the TIA.	0	0
Basis engineering principles	X	X	X	X	0	0	0
Hydraulic systems	X	X	X	X	0	0	0
Oxygen/oxygenation systems	X	X	X	X	0	0	0
Pressure/vacuum systems	X	X	X	X	0	0	0
Wheels, tires, brakes	X	X	X	X	0	0	0
Air conditioning systems	X	X	X	X	0	0	0
Passenger safety/crashworthiness	X	X	X	X	0	0	0
Rain removal/defogging systems	X	X	X	X	0	0	0
Cargo handling waste systems (large A/C)	X	X	X	X	0	0	0
Dzone protection with high-energy motors	X	X	X	X	0	0	0
Gen. knowl. of functional components (pro. sys.)*	X	X	X	X	0	0	0
Interference, critical components (pro. sys.)*	X	X	X	X	0	0	0

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1

TECHNICAL KNOWLEDGES (Continued)

TECHNICAL KNOWLEDGES	TASKS	KEY					
		X	0	+	-	*	#
Air conditioning systems	Writes or assists in writing flight test section of TIA.	X	0	X	X	X	X
Hydraulic systems	Prepares or reviews and accepts applicant's compliance checklist.	X	0	X	X	X	X
Oxygen/protection systems	Reviews applicant's proposed flight test program.	X	0	X	X	X	X
Pneumatic systems	Reviews applicant's proposed flight test program.						
Wheels, tires, brakes systems	Reviews applicant's proposed flight test program.						
Airframe flight control systems	Reviews applicant's proposed flight test program.						
Passenger safety/crashworthiness	Reviews applicant's proposed flight test program.						
Cooling/heating systems	Reviews applicant's proposed flight test program.						
Potable/waste systems	Reviews applicant's proposed flight test program.						
Gearbox handling systems (large A/C)	Reviews applicant's proposed flight test program.						
Dzone protection systems (large A/C)	Reviews applicant's proposed flight test program.						
Gen. knowl. of functional components of A/C sys./sys.	Reviews applicant's proposed flight test program.						
Interface, critique components of A/C sys./sys.	Reviews applicant's proposed flight test program.						

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1

TECHNICAL KNOWLEDGES (Continued)

TECHNICAL KNOWLEDGES	KEY	TASKS	NUMBER OF PANELISTS = 6					
			0	0	0	0	0	0
Air conditioning principles	X	Participates in the establishment of the U.S. certification basis.						
Hydraulic systems	X	Identifies the need for and develops issue papers during the certification program.						
Oxygen/protection systems								
Pneumatic systems, tires, brakes								
Wheels, tires, brakes								
Air conditioning and heating								
Powerplant flight controls								
Aircraft protection systems								
Passenger safety/crashworthiness								
Cooling/heating systems								
Rain removal/waste systems for elec. equip.								
Gauge handling systems (large A/C)								
Dzone protection systems (large A/C)								
Gen. knowl. of functional components (pro. sys., svcs.)								
Interference, critical components (pro. sys., svcs.)								

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1
TECHNICAL KNOWLEDGES (Continued)

TECHNICAL KNOWLEDGES	TASKS					
	Prepares and coordinates TIA.	Facilitates resolution of differences of opinion with project team and with applicant or directorate.	Reviews and approves drawings and material and process specifications and makes findings of compliance.	Design Approval: PHA AND TSO	Design Approval: PHA AND TSO	Design Approval: PHA AND TSO
Basic engineering principles	0	0	0	0	0	0
Hydraulic/electrical systems	0	0	0	0	0	0
Oxygen/protection systems	0	0	0	0	0	0
Wheels, tires, brakes	0	0	0	0	0	0
Air conditioning systems	0	0	0	0	0	0
Fire protection systems	0	0	0	0	0	0
Power distribution systems	0	0	0	0	0	0
Airframe icing protection controls	0	0	0	0	0	0
Passenger safety/crashworthiness	0	0	0	0	0	0
Cooling/heating systems	0	0	0	0	0	0
Portable/waste master systems (large A/C)	0	0	0	0	0	0
Dzone handling systems (large A/C)	0	0	0	0	0	0
Gen. knowl. of functional components (pro. sys.)*	0	0	0	0	0	0
Interface, critical components (pro. sys.)*	0	0	0	0	0	0

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1

TECHNICAL KNOWLEDGES (Continued)

TECHNICAL KNOWLEDGES	KEY	TASKS					
		BASIC engineering principles	Pressure/vibration systems	Air compressive systems	Fire protection systems and heating	Passenger safety/crashworthiness	Rain removal/defogging systems
Wheels, tires, brakes systems	0	X	X	X	0	X	0
Hydraulic protective breathing systems	0	0	0	0	0	0	0
Oxygen/protection systems	0	0	0	0	0	0	0
Pressurization systems	0	0	0	0	0	0	0
Air compressive systems	0	0	0	0	0	0	0
Fire protection systems	0	0	0	0	0	0	0
Passenger safety/crashworthiness	0	0	0	0	0	0	0
Rain removal/defogging systems	0	0	0	0	0	0	0
Airframe lighting controls	0	0	0	0	0	0	0
Passenger safety/crashworthiness	0	0	0	0	0	0	0
Gear/o handling waste systems (large A/C)	0	0	0	0	0	0	0
Dzone protection systems (large A/C)	0	0	0	0	0	0	0
Gen. knowl. of functional components of A/C sys.	0	0	0	0	0	0	0
Interfacing, critical components of A/C sys.	0	0	0	0	0	0	0
Equipmen with high-energy rotors	0	0	0	0	0	0	0
Zone protection systems (large A/C)	0	0	0	0	0	0	0
Cargo handling waste systems (large A/C)	0	0	0	0	0	0	0
Potable/waste defogging systems	0	0	0	0	0	0	0
Goal removal/defogging systems	0	0	0	0	0	0	0
Heating/heatng systems	0	0	0	0	0	0	0
Passenger safety/crashworthiness	0	0	0	0	0	0	0
Rain removal/defogging systems	0	0	0	0	0	0	0
Passenger safety/crashworthiness	0	0	0	0	0	0	0
Gear/o handling waste systems (large A/C)	0	0	0	0	0	0	0
Dzone protection systems (large A/C)	0	0	0	0	0	0	0
Gen. knowl. of functional components of A/C sys.	0	0	0	0	0	0	0
Interfacing, critical components of A/C sys.	0	0	0	0	0	0	0

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1

TECHNICAL KNOWLEDGES (Continued)

TECHNICAL KNOWLEDGES		TASKS	REVIEWS THE TECHNICAL WORK AND LEVEL OF ACTIVITY OF THE DER FOR COMPLIANCE WITH REGULATIONS.	SERVICE DIFFICULTY	DRAFTS AND COORDINATES AIRWORTHINESS DIRECTIVE, EXECUTIVE SUMMARY, AND OTHER DOCUMENTS, AS APPLICABLE.	PARTICIPATES IN ACCIDENT AND INCIDENT INVESTIGATIONS.
KEY	NUMBER OF PANELISTS = 6					
X	Half or more of panelists linked KSA to task	Oxygen/protective principles	O	0		
0	Fewer than half of panelists linked KSA to task	Pressure/vibration systems	X	X		
Blank	KSA not linked to task	Hydrostatic systems	X	X		
		Wheels, tires, brakes, steering	X	X		
		Air condition systems	X	X		
		Fire protection systems	X	X		
		Airframe flight control systems	X	X		
		Passenger safety/crashworthiness	X	X		
		Rain removal/deicing systems	X	X		
		Cooling/heating systems	X	X		
		Portable/waste heating systems	X	X		
		Gearbox handling systems (large A/C)	X	X		
		Equipment which high-energy rollers	X	X		
		Gen. knowl. of functional components of A/C sys./sys.*	X	X		

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA's TO JOB CRITICAL TASKS**

TABLE B-1
TECHNICAL KNOWLEDGEES (Continued)

TECHNICAL KNOWLEDGES	KEY	NUMBER OF PANELISTS = 6	TASKS	REGULATORY DEVELOPMENT					
				0	X	X	X	X	O
BASIC ENGINEERING PRINCIPLES	X								
PRESSURIZATION SYSTEMS									
HYDRAULIC SYSTEMS									
OXYGEN/PROTECTIVE SYSTEMS									
WHEELS, TIRES, BRAKE SYSTEMS									
AIR CONDITIONING SYSTEMS									
POWERED FLIGHT CONTROLS									
PASSenger SAFETY/CRASHWORTHINESS									
COOLING REMOVAL/DEFOGGING SYSTEMS									
CARGO HANDLING SYSTEMS FOR ELEC. EQUIP.									
OZONE PROTECTION SYSTEMS (LARGE A/C)									
GEN. KNOWL. OF TURBINE COMPONENTS (PROJ. SYS.)*									
INTERFACe, CRITICAL COMPONENTS (PROJ. SYS.)*									

* Linkage information for this KSA was provided by three project managers representing a cross-section of engineering disciplines.

TABLE B-2
FAA/INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS**

**TABLE B-2
FAA-INDUSTRY KNOWLEDGE AND SKILLS/ABILITIES**

FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY		
KEY		
X	= Half or more of panelists linked KSA to task	
0	= Fewer than half of panelists linked KSA to task	
Blank	= KSA not linked to task	
NUMBER OF PANELISTS = 13		
		TASKS
		Drawing systems and standards
		Manufacturer's publications
		Governments and industry standards
		FMA/ACRP missions, reg., policies, and standards
		Permitting structures, e.g., polices, and standards
		FMA org. structures, e.g., functions, relationships/procs.
		Aviation services available for support/proc.
		Facilities/agreements with business/proc.
		Human relations skills
		Communication skills
		Personal management of time and workload
		Analytical ability in problem solving
		Office automation/basic computer skills
		Aircraft operations/maintenance proc.

DESIGN APPROVAL: DOMESTIC

Advises potential applicant regarding requirements related to certification program.

Becomes familiar with the applicant's design/product.

Participates in the establishment of a certification basis.

APPENDIX B

**AAC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS**

**TABLE B-2
FAA-INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES (Continued)**

		FAA- INDUSTRY KNOWLEDGE OR SKILL/ABILITY									
		KEY									
		TASKS									
X	= Half or more of panelists linked KSA to task	Identifies the need for and develops issue papers during the certification program.	0	0	0	X	0	0	X	0	0
0	= Fewer than half of panelists linked KSA to task	Schedules and conducts project-specific meetings (specialist meetings) with the applicant.	0	0	0	X	0	0	X	0	0
Blank	= KSA not linked to task	Reviews applicant's certification plan for completeness and provides feedback.	0	0	0	X	0	0	X	0	0
NUMBER OF PANELISTS = 13		Linkage information not collected for this task.									
Drawing systems and standards											
Manufacturer's products and standards											
Performance to cert., reg., pol. offices, and proc.											
FM units. reliable for supports with aircraft manufacturers and											
FMA org. struct./func./rel. associations/creatin											
resources assess. rel. to cert. oferonutric. prod./prod. /											
Human relat. agreements reg. policies and											
Communication skills											
Personal management of time and workload											
Analytical ability in problem solving											
Office automation/basic computer skills											
Aircraft operations/internce proc.											

APPENDIX B

**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS**

TABLE B-2

FAA-INDUSTRY KNOWLEDGE AND SKILLS/ABILITIES (Continued)

		FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY												
		KEY												
		TASKS												
	X	Reviews and approves safety analyses (e.g., fault/failure analysis, FMEA) with respect to certification criteria.												
	O	Reviews and approves test plans/procedures.												
		Reviews and approves drawings and material and process specifications for certification projects and makes findings of compliance.												
NUMBER OF PANELISTS = 13														
	X	Drawing systems and standards												
	O	Manufacturers' publications and standards												
	O	Performance and industry standards												
	O	FAA/ACRP missing to cert.,/func./relational types/proc.												
	O	PM org. struct./func./rel. of seconutary offices, and proc.												
	O	Resources, services, rel. to cert.,/func./relational types/proc.												
	O	Design, analysis, and proc. soc/crafts/proc.												
	O	Human resources, reg. and proc.												
	O	Communication skills												
	O	Personal management of time and workload												
	O	Analytical ability in problem solving												
	O	Office automation/basic computer skills												
	O	Aircraft operations/maintenance procedures												

APPENDIX B

**AOD MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS**

TABLE B-2

FAA-INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES (continued)

		FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY												
		KEY												
		X = Half or more of panelists linked KSA to task												
		0 = Fewer than half of panelists linked KSA to task												
		Blank = KSA not linked to task												
NUMBER OF PANELISTS = 13		TASKS												
		Reviews and approves test results.												
		Reviews and approves analyses.												
		Evaluates and makes recommendations on a request for an equivalent level of safety finding.												
		Provides input items to the TIA.												
		Drawing systems and standards												
		Manufacturing and industry standards												
		FMA/ACRP missision, res., policies, and proc.												
		FMS org. struc./func./relate functions/proc.												
		Procurement, rel. for support/tech. services and products.												
		Bilateral, regional, and proc. agreements req'd/rel.												
		Human resources skills												
		Personal management skills												
		Analytical ability in problem solving												
		Skill in applying the FAR												
		Office automation/basic computer skills												

APPENDIX B

**AICD MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS**

TABLE B-2

FAA-INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES (continued)

		FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY										
		KEY										
		X = Half or more of panelists linked KSA to task O = Fewer than half of panelists linked KSA to task Blank = KSA not linked to task										
		NUMBER OF PANELISTS = 13										
		TASKS										
		Writes or assists in writing TIA.										
		Prepares or reviews and accepts applicant's compliance checklist.										
		Reviews applicant's proposed flight test program.										
		Assists engineering specialties in resolving technical issues.										
		Linkage information not collected for this task.										
		Linkage information not collected for this task.										

APPENDIX B**ACO MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS****TABLE B-2****FAA-INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES (continued)**

FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY		TASKS									
KEY											
X	= Half or more of panelists linked KSA to task										
O	= Fewer than half of panelists linked KSA to task										
Blank	= KSA not linked to task										
NUMBER OF PANELISTS = 13											
DESIGN APPROVAL: FOREIGN											
Becomes familiar with the applicant's design/product.											
Participates in the establishment of the U.S. certification basis.											
Identifies the need for and develops issue papers during the certification program.											
Linkage information not collected for this task.											

APPENDIX B

**A&O MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSAs TO JOB CRITICAL TASKS**

TABLE B-2

FAA-INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES (Continued)

FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY		NUMBER OF PANELISTS = 13	TASKS						
KEY									
X = Half or more of panelists linked KSA to task									
0 = Fewer than half of panelists linked KSA to task									
Blank = KSA not linked to task									
Drawing systems and industry standards			DESIGN APPROVAL: PROJECT MANAGEMENT						
Manufacturing, inspection, reg., pol. etc., and prod.			Coordinates the establishment of overall program certification basis including special conditions and exemptions.						
FAA/A&C/P missed mission, reg., policy, and prod.			Prepares and coordinates TIA.						
Performance and industry standards			Facilitates resolution of differences of opinion with project team and with applicant or directorate.						
Regulatory issues, public factors			PROJECT MANAGEMENT						
PM org., func., relatable to cert., of renewals/techs/prod.			Coordinates the establishment of overall program certification basis including special conditions and exemptions.						
Personnel services, relatable for supplier types/proc.			Prepares and coordinates TIA.						
PM func., relatable to cert., of renewals/techs/prod.			Facilitates resolution of differences of opinion with project team and with applicant or directorate.						
Human resources, regulations, and prod.			PROJECT MANAGEMENT						
Compliance regulations			Coordinates the establishment of overall program certification basis including special conditions and exemptions.						
Personal management skills			Prepares and coordinates TIA.						
Proj. mgmt./team leadership skills			Facilitates resolution of differences of opinion with project team and with applicant or directorate.						
Analytical ability in problem solving			PROJECT MANAGEMENT						
Office automation/basic computer skills			Coordinates the establishment of overall program certification basis including special conditions and exemptions.						
Aircraft operation/base of computer skills			Prepares and coordinates TIA.						

APPENDIX B

AOC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS

TABLE B-2

FAA-INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES (Continued)

		FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY									
		KEY									
		TASKS									
DESIGN APPROVAL: PMA AND TSO											
Reviews and approves drawings and material and process specifications and makes findings of compliance.		X	X	X	X	X	0	0	0	0	0
Reviews and approves analyses.											
Prepares letter of TSO authorization after appropriate review required by Part 21, Subpart O and the specific TSO.											

APPENDIX B

AOC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS

TABLE B-2
FAA-INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES (Continued)

FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY		TASKS
KEY		
X	= Half or more of panelists linked KSA to task	
0	= Fewer than half of panelists linked KSA to task	
Blank	= KSA not linked to task	
NUMBER OF PANELISTS = 13		
DRAWING SYSTEMS AND STANDARDS		
MANUFACTURER'S PRODUCTS AND STANDARDS		
FAA/ACP REGULATIONS		
PERFORMANCE, RELIABILITY, SUPPORT/CRASHING		
FAA/TUKE, SERVICE, RELIABILITY, SUPPORT/PRODUCTS		
RESOURCES, RELATIONSHIPS WITH SUPPLIERS/PRODUCTS		
OPERATION, RELATIONSHIPS WITH SUPPLIERS/PRODUCTS		
HUMAN RELATIONS SKILLS		
COMMUNICATION SKILLS		
PERSONAL MANAGEMENT OF TIME AND WORKLOAD		
PROJECT, TEAM/TEAM LEADERSHIP SKILLS		
SKILL IN APPLYING THE FAR		
OFFICE AUTOMATION/BASIC COMPUTER SKILLS		
AIRCRAFT OPERATIONS/INSTRUMENTATION PROC.		

APPOINTMENT AND SURVEILLANCE OF DESIGNEES AND DESIGNATED FACILITIES

Assesses the qualifications of the staff members who will exercise authority under the delegation as a designated organization (DOA, DAS, or SFAR 36).

Reviews the technical work and level of activity of the DER for compliance with regulations.

APPENDIX B

**AOC MECHANICAL-ENVIRONMENTAL SYSTEMS ENGINEERS:
PRELIMINARY LINKAGE OF KSA'S TO JOB CRITICAL TASKS**

TABLE B-2

FAA-INDUSTRY KNOWLEDGES AND SKILLS/ABILITIES (Continued)

FAA-INDUSTRY KNOWLEDGE OR SKILL/ABILITY		KEY	TASKS
SERVICE DIFFICULTY	NUMBER OF PANELISTS = 13		
Drafting systems and standards	0	X	Participates in accident and incident investigations.
Manufacturers' publications and standards	0	O	Drafts new or revised TSO, when requested.
Governments and industry standards	0	X	Participates in accident and incident investigations.
FAA/ACRP missision, reg., policies, and procedures	0	O	Drafts new or revised TSO, when requested.
FAA/TUUC, reg., policies, of aeroroute/proc.	0	O	Participates in accident and incident investigations.
Personnel services, relatable for supplier/services/products/proc.	0	O	Drafts new or revised TSO, when requested.
Pilot/flight syllabus, relatable for supplier/services/products/proc.	0	O	Participates in accident and incident investigations.
Human resources, regulations, sci/tech, and proc.	0	O	Drafts new or revised TSO, when requested.
Business/relational/agreements, regulations, sci/tech, and proc.	0	O	Participates in accident and incident investigations.
Personal certification skills	0	O	Drafts new or revised TSO, when requested.
Proj. mgmt./team leadership skills and work load	0	O	Participates in accident and incident investigations.
Analytical ability in time and problem solving	0	O	Drafts new or revised TSO, when requested.
Office automation/basic computer skills	0	O	Participates in accident and incident investigations.
Aircraft operations/maintenance/computer skills	0	O	Drafts new or revised TSO, when requested.

KEY

X = Half or more of panelists linked KSA to task

O = Fewer than half of panelists linked KSA to task

Blank = KSA not linked to task

NUMBER OF PANELISTS = 13

